ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVIII. No. 3571. MAY 3, 1946 9d. WEEKLY

Heat-Pump Economics

Special Conditions in this Country

THE public has been brought to realize the need for greater economy in the use of coal, more particularly of certain types, and consequently much interest has centred on methods that seem to promise savings in this way. This interest is to be welcomed so long as any hopes it may breed are founded on scientific possibilities that do not stray too far from what is technically feasible and economically practicable.

The idea embodied in the heat pump of obtaining an equivalent number of BThU for warming buildings for perhaps one-third the consumption of fuel is naturally attractive. Its scientific basis was shown to be sound by Lord Kelvin about the middle of the last century and its technical aspects were developed by Mr. T. G. N. Haldane in an I.E.E. paper some seventeen years ago. There remains the more difficult problem of balancing capital and running charges for a complete heating system of this type that is suited to the climatic conditions of this country against alternative methods for which data derived from many years of experience are readily available.

Favourable Factors

It does not by any means furnish a complete answer that many heat pumps are in commercial operation in Switzerland. Although considerable progress has been made there (especially in connection with industrial processes, which have at least one counterpart in Britain), this has been largely the result of peculiar conditions arising out of the war as Mr. B. Wood's first-hand investigation (published by us this week) shows and the success obtained rests on several factors which do not apply to British conditions. Moreover the wider fluctuations in winter temperatures here may (in view of the high first cost of the plant) call for the installation of units of a size insufficient to dispense with supplementary heating. The relatively low annual load factor, except in the unusual event of a combination of air conditioning or refrigeration in summer, such as obtains in Zürich, presents a further obstacle to wider adoption.

Heating Commercial Buildngs

In Switzerland the practice is to base economic comparisons on the ratio of the cost of a kilogramme of coal to the cost of a kWh, parity being reached with radiation heating when the former somewhat exceeds the latter. This allows a high price for electricity, as coal (when obtainable) costs several times as much as it does in this country. There appears then little reason to expect the heat pump to make any appreciable contribution towards the rehousing programme.

A more promising field is provided by commercial buildings in which low-temperature panel-heating which, with its extensive emission surface, is especially favourable to the characteristics of the heat pump, the efficiency of which varies inversely with the temperature difference between the source and point of utilization of the heat. The experimental installation described by Mr. J. A. Sumner in this issue serves premises of this type and his

expectations from his projected miniature "district heating" system find support in the contention of Mr. R. K. Thulman (as a result of experience in the United States), in his recent lecture to the Institution of Heating and Ventilating Engineers, that small local boiler plants serving a few buildings are usually much less costly to install and maintain than are more ambitious schemes, some of which are dependent upon electric power stations. Operating results at Norwich over a longer period will be awaited with interest.

English Electric and Marconi's

ALTHOUGH negotiations have been proceeding for the past two years, quite independently of the Government's nationalization proposals, it was considered opportune last week to announce the intention of the English Electric Co., Ltd., to purchase the interest of Cable & Wireless (Holding), Ltd., in Marconi's Wireless Telegraph Co., Ltd. By this acquisition the English Electric Co. still further extends its catholicity of interests which now range from the largest turbo-generators, oil engines and transformers to light electronic equipment.

Atomic Power

NOT for the first time has a seemingly academic research yielded far-reaching practical results, but none has been fraught with such momentous possibilities as has the result of nuclear fission, which has so sensationally demonstrated the vast amount of energy that can be exchanged for a minute quantity of mass as it vanishes. Political and military issues must be cleared up, Professor M. L. Oliphant stressed in his Kelvin Lecture last week, before this source of energy can be applied to large industrial uses. That must be the ultimate purpose and development after international action on the lines of the Lilienthal Report has ruled out the unthinkable alternative. In the meantime the British Government is taking steps to control research and development in this country.

Electricity and Nuclear Fission

IN view of the costly and extensive works needed for splitting heavy nuclei to start chain reactions and for the initial separation of the isotope U235 from uranium ore as well as the great weight of shielding against injurious radiations, the opening of an era of cheap power in the near future seems unlikely. The production of radio-active substances with possible uses in medicine and metullurgy will possibly come first. If coal and oil resources become seriously diminished, the economic balance will, of course, become more favourable to the application of nuclear energy. Steam raised by means of heat produced in piles by nuclear chain reactions could drive turbo-alternators, but this would not affect the method of distributing electricity, which would provide the most convenient means of using atomic energy.

Export Advance Continues

LAST week's leading article was written before the Board of Trade returns of overseas trade in March were available. These reinforce our optimism regarding the electrical industry's ability to meet its export demands and our argument in favour of Government support and encouragement. Last month the electrical export total exceeded £4 million, a figure which has never been reached in any previous month; it was nearly 125 per cent above the average monthly figure for 1938—in itself a good year. In terms of volume, assuming a rise in price levels between 70 and 80 per cent, March exports were well above the pre-war rate, though still some way short of the aim. The British Electrical & Allied Manufacturers' Association considers that an annual total of £65 million must be the goal.

Tempered Optimism

THIS and other considerations must check any tendency to regard the position as entirely satisfactory. At the moment the world is avid for all kinds of goods, especially the electrical equipment which is urgently needed in reconstruction. Consequently countries which were but poor customers before the war are now eager purchasers. This applies particularly to some European states who may not remain with us when immediate needs are satisfied. It is noteworthy that exports to Latin America are only slightly above 1938 values; we may once again have to call in the New World to redress the balance of the old when some of our present customers get on their feet again.

The Heat Pump

Notes on Some Swiss Installations

By B. Wood

IN view of the recent interest aroused in the heat pump in this country it may be of value to record the impressions received during a recent visit to Switzerland. Swiss firms were already interested in the heat pump before the war, and war conditions have brought about a great extension of the field of application.

Switzerland has now a larger aggregate capacity of heat pumps than any other country. Its adoption has not been entirely a voluntary measure: it has been enforced by the high price and the great shortage of coal. Coal imported from Germany was costing 120–150 Swiss francs, equivalent to £7 to £9 per ton, and even so supplies were very restricted. There was thus strong economic compulsion towards making use of indigenous water power resources wherever electricity could be substituted for fuel. A further favourable consideration was that three firms, Escher Wyss, Brown Boveri, and Sulzer Bros., were all experienced in the manufacture of equipment and during the war none of these can have been fully occupied with normal work.

The abundance of water power may seem at first sight to be rather a factor against the economy of energy. However, since most of the rivers in Switzerland derive their flow mainly from melting snow, the capacity of hydro-electric plants tends to be reduced in mid-winter and hence a large increase of the winter peak demand, such as would result from wider use of direct electric heating, has to be discouraged by suitable tariffs. The high price of electricity during the winter peak, therefore, justifies capital expenditure on heat pumps.

In the application to building heating the heat pump is simply a refrigerator (not a reversed refrigerator, it may be remarked). In a refrigerator we are normally interested in the cool end of the cycle, while in the heat pump we are interested in the warm end but the process is precisely the same (see Fig. 1). Pumping up heat entails cooling the source and it is considered that the River Limmat at Zürich has been cooled by a fraction of a degree by the heat pumps at present in service. While it is not impossible to use the atmosphere as a source of heat, flowing water is a great deal more convenient and in this respect Switzerland is particularly well placed in that almost all the larger towns are situated on rivers or lakes. Precautions have to be taken to avoid the evaporator surface becoming iced over.

The machines take the form of either reciprocating compressors or centrifugal machines. Sulzer Bros. and Escher Wyss are interested in reciprocators with which ammonia is the usual refrigerant. Both use a stepped piston multi-stage design for larger sizes. For smaller duties Escher Wyss also make an eccentric lobe type compressor with oscillating abutment. Brown Boveri manufacture only rotary machines and generally employ Freon 11. This is non-toxic and is well suited to centrifugal compressors since it involves large volumes at moderate pressures. The two types overlap to a certain extent but the reciprocator holds the field below about 1 million BThU per hour while, in very large sizes, the rotary machine is lower in first cost and maintenance besides being less bulky and more silent though it may be slightly less efficient. For industrial evaporating plants handling water vapour, centrifugal or axial machines alone come into consideration owing to the large volumes

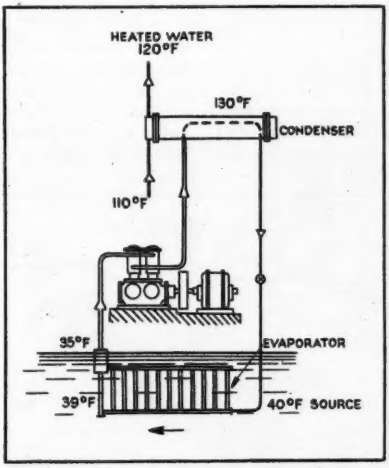


Fig. 1.—Operation of a heat pump unit

involved. Brown Boveri and Escher Wyss both make these.

With ammonia, it is permissible to place the evaporator in a stream at some distance from the compressor and to allow the liquid ammonia to run down to the evaporator by gravity. It is also proposed to heat rooms direct from the condenser, re-circulating warm air rather than hot water. A fairly considerable pressure drop in the vapour pipe returning to the compressor can be tolerated. With Freon 11 on the other hand, the pressure ratio in the system being much smaller, pressure drop is objectionable and consequently Brown Boveri construct their plants in the form of a so-called "Thermo-block" in which the evaporator and condenser are an integral part of the machine, the compressor with its driving motor being either mounted within the casing or alternatively on top of it. The erection of such a plant consists, therefore, only of placing the unit on prepared foundations and connecting up the water pipes to the cold and hot circuits.

Fig. 2.—Five Escher Wyss ammonia compressors at Zürich Swimming Bath

In Zürich the Town Hall (Rathaus), the Municipal Offices (Amtshaeuser) and the large new indoor swimming bath owned by the municipality all have their own heat pumps. Fig. 2 shows the swimming bath plant. The largest and most recent installation at the Walcheplatz operates in conjunction with a district heating plant at the Federal Technical Institute ("Polytechnic") and has taken over the base load heating requirements of a group of buildings including the Polytechnic, the University and a number of hospital buildings and flats in the vicinity. Particulars of these plants are contained in Table 1. In addition to these, Brown Boveri and Escher Wyss, both heat their works and office buildings with heat pumps of their own manufacture. Escher Wyss have manufactured thirty-one machines for building heating.

In most cases the heat pump is complementary to a fuel-fired installation which

TABLE I.—HEAT PUMPS IN ZÜRICH FOR BUILDING HEATING

Date	Installation	No. of units	Total capacity[2] Million BThU/hr	Type	Refrigerant	C.O.P.	Annual coal saving Tons	Annual consumption kWh	Motor kW	Max. temp. °F
1937	Town Hall[1] (Rathaus)	1	0·28	recip. 1 cyl. 1 stage	Freon 12	2		90,000	40	140
1939	Congress House[1] (Kongress-haus)	1	0·2	Lèbre cell wheel	Air	2½				68
1941	Swimming Bath (Hallenbad)	5	4·8	recip. 2 cyl. 2 stage	Ammonia	7 to 3½	900	2×10^6	3×94 2×63	113 and 74
1944	Federal Technical Institute (Walcheplatz)	3	18	1 recip. (3 cyl.) 3 stage 2 centrif.	Ammonia Freon 11	3	3,200	6×10^6	850 2×1,100	158
1945	Municipal Offices (Amtshaeuser)	4	6	recip. 2 cyl. 2 stage	Ammonia	4	720	$1{\cdot}2\times10^6$	4×135	122

[1] Both have supplementary electric heat storage and serve also for cooling in summer.
[2] Basis 35·6 deg F source temperature.

already existed. The heat pump is accordingly dimensioned only to cover the base load, say two-thirds of the peak heating demand. This is sufficient to cover about 90 per cent of the heat consumption over the year.

Fuel in the form of wood (sometimes pine cones) or coal (if it is procurable even at high price) is the most economical means of meeting the very low load factor demand represented by the excess of the peak over the base load. This excess load has a duration of only a few days and the high capital cost of a heat pump plant to cover it would be difficult to justify. Operation of a fuel-fired heating system in parallel with a heat pump introduces an awkward problem. The combined effect of low source temperature and coincident high hot water temperature required in a cold snap is to reduce considerably the capacity of the heat pump just at the time when maximum output is required. Hence, the duty to be taken over by the fuel-fired installation amounts to rather more than lopping the peak.

The capital cost of Swiss installations for building heating has been given as £3·7 to £6·4 per 1,000 BThU per hr for sizes of 12 to 2 million BThU per hr. This includes installation with pipework except the hot water distribution pipes and radiators.

Wartime Progress

During the war a very considerable development has taken place in the application of heat pumps to industrial evaporating processes including salt and chemical manufacture, fruit juice concentration, condensed milk production and drying processes in textile industries. Brown Boveri have supplied some thirty-two machines for these purposes (fifteen of them during 1945). Escher Wyss have supplied eighty-five such units including the largest heat pump in the world, shown in Fig. 3. This evaporates 220,000 lb per hr. The entire salt requirements of Switzerland, some 80,000 tons per annum, are produced by evaporating brine without the use of fuel, thus saving 24,000 tons of coal per annum and using instead 20 million kWh.

Though these plants are akin to heat pumps, they represent a rather special case in that the cycle is, so to speak, doubled back on itself, the evaporator and condenser being the same vessel; the circuit is shown schematically in Fig. 4. Vapour (generally water) produced initially by heat introduced externally is taken up by the compressor and compressed into the heating coil within the evaporator vessel. It is condensed therein, giving up its latent heat to the liquid and thus producing more vapour.

The process, once it is started, is self maintaining and, since there is no loss of latent heat and some of the sensible heat in the concentrated liquor and in the condensate from the coil can be transferred to the incoming liquor, the process can be more efficient than multi-effect evaporation. Plants of this type are held to be competitive with quadruple effect evaporators where one kWh costs no more than one kilogram of coal as this has been found to be about the equivalent conversion in certain industries.

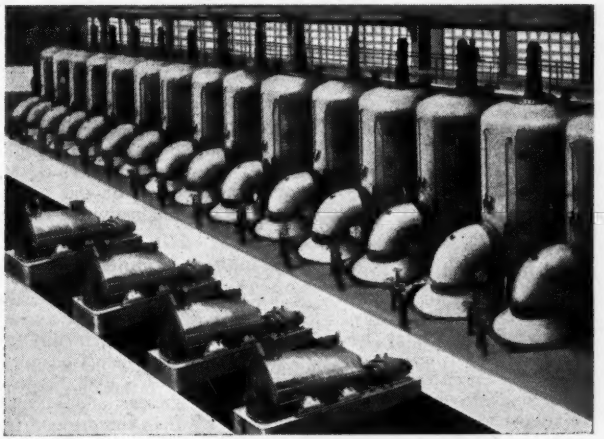


Fig. 3.—The largest compressor-evaporator plant in the world—220,000 lb per hour capacity (four compressors)

This means that with off-peak energy at 4 centimes (0·56d.) per kWh and coal at 150 Swiss francs per ton (£8 14s. 0d.) the cost per kg of coal at 15 centimes was nearly four times as high as that of electricity.

Hence, a compressor evaporator plant was able to pay off its capital cost in a short time. If coal falls to a price of 50 Swiss francs per ton (£2 18s. 0d.) a quadruple effect evaporator will have much the same running cost as a compressor evaporator. The case for the compressor evaporator would then turn on any difference in capital cost compared to an equivalent four stage evaporator.

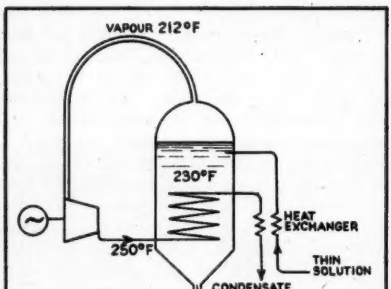


Fig. 4.—Industrial compressor-evaporator plant

It has been found that the compressor evaporator has an advantage in operating at a lower temperature in that the product is often better and there is less danger of damage by burning. It thus seems likely that the industrial application of the heat pump to evaporating processes may continue even if the cost of fuel falls to a more moderate level.

In this field, the plant has the advantage of operating at high load factor and contracts for the supply of electricity can therefore be negotiated at a lower price than in the case of building heating which does not have a high load factor unless combined with air conditioning in the summer. Two smaller installations in Zürich combine the two but even in central Europe there are not many days in an average year on which the temperature is so high that tolerable comfort conditions cannot be obtained by ventilation and by screening of windows.

The Norwich Heat Pump

Experience with Experimental Plant

By John A. Sumner,
M.I.E.E., M.I.Mech.E., F.I.I.A.

FOR centuries we have been blessed with an abundant quantity of free carbon in the form of timber and coal. The combination of carbon with oxygen by the process of combustion permits high-grade heat to be obtained at high temperatures, and the degrading of that heat—by means of the steam or internal-combustion cycle—has meant that between 10 and 30 per cent of the energy can be converted into other useful forms of energy. The ready availability of high-grade heat energy has caused us to ignore the much more abundant sources of low-grade heat energy, which exist in rivers, pools, underground water supplies and in the atmosphere, which can be upgraded at a much higher efficiency than in the wasteful process of degrading heat.

Provided these sources are available at or near the point at which the heat is required, the process of upgrading heat within certain temperature limits is an economic one for many commercial uses. It possesses features unique in engineering experience in that we can obtain from three to six times as much heat energy as that put in mechanically, the balance of this upgraded heat being available free from the water or air around us. This upgrading can be performed by the reversed heat engine or heat pump, as was indicated by Kelvin in 1851 and was brought out clearly by T. G. N. Haldane in 1930 in a paper on the subject which he read before the Institution of Electrical Engineers.

Nevertheless only a score or so heat pumps are known to be in use for building heating in the world, and probably only one, at Norwich, in this country. There are many possible reasons for this lack of development. One is that the demand for power has been greater and commercially more profitable than the demand for heat, *per se*. Efficient power production requires the greatest practicable difference between the upper and lower temperatures, i.e., the greatest amount of degrading.

A second reason is that coal has been relatively cheap in this country until 1939, so that for plant required solely for building heating it has been much easier to burn coal and thereby to degrade heat, however inefficient the subsequent use, than to install

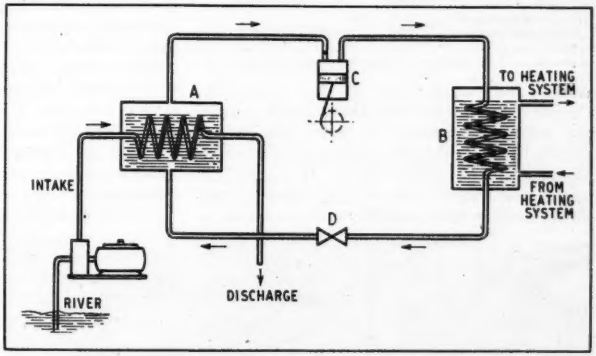
plant to upgrade heat. There have been hitherto no reliable data available, and it has been too readily assumed that the cost of upgrading heat is too greatly in excess of the cost of degrading to be commercially practicable.

Moreover, any new process is subject to prejudice and opposition, the use of the heat pump being no exception. Experience would suggest that the principle of the heat pump is either misunderstood or not appreciated by a majority of engineers, who defer to the theory but are opposed in practice to the acceptance of a machine which can have an "efficiency" greater than unity. The heat pump is a refrigerating plant which works within wider pressure and temperature limits than are required for refrigeration; gas temperatures range from 30 deg F for T2 to 200 deg F for T1. Instead of being extracted from a cold chamber however, the heat is drawn either from the atmosphere or cold water, where it exists at a temperature too low to serve any useful purpose and is then raised in the heat pump to a temperature high enough to warm a room.

Kelvin stated that if a heat-engine has an *absolute* inlet temperature T_H and an exhaust or refrigerator *absolute* temperature T_L—"the efficiency of a perfect heat-engine is expressed by the ratio of the difference of the absolute temperatures of the source and condenser to the absolute temperature of the source," i.e., thermal efficiency = E = Heat converted into work / Heat taken in by engine $= \frac{T_H - T_L}{T_H}$. Assuming working terminal temperatures of T_H = 180 deg F (640 deg abs) and T_L = 80 deg F (540 deg abs), $E = \frac{640 - 540}{640} =$ 0·156 or 15·6 per cent, for the perfect engine.

If the cycle of operation of the ideal heat-engine is reversed and instead of supplying heat at high temperature and rejecting what heat is left at low temperature after work has been done, we take in heat at low temperature, do work on it and complete the cycle so as to have heat at a higher temperature, the reciprocal of the above expression will be obtained, i.e., $\frac{1}{E} =$ •

Heat delivered at high temperature / Work expended to raise temperature $= \frac{T_H}{T_H - T_L} = \frac{640}{640 - 540}$, i.e., $6{\cdot}4\left(\text{or } \frac{1}{\cdot 156}\right) =$ 640 per cent and so the heat delivered is 6·4 times greater than the heat equivalent of the mechanical or electrical energy expended to carry out the operation. Thus, instead of burning 1 lb of coal of, say, 10,000 BThU to obtain 2,400 BThU as electrical energy and then by means of resistances, converting the electrical energy into heat energy to obtain about 2,350 BThU, we use 10,000 BThU's of mechanical or electrical energy in the heat pump and finish with 6·4 × 10,000 or 64,000 BThU of higher-grade heat. In practice, after allowing for the loss of efficiency in the heat transfer of about 50 per cent (as compared with the ideal cycle), we can and do obtain from the reversed heat-engine 32,000 BThU for each 10,000 BThU expended. If $T_H - T_L$ is only 50 deg F the ideal "reciprocal thermal efficiency" would be 1,280 per cent and the actual about 640 per cent.



Elementary circuit diagram of pipe connections

The heat pump, which has recently been substituted for solid-fuel boilers for heating the stores and office building of the Norwich Corporation Electricity Department, delivered between October 8th and November 16th, 1945, 1,562 therms for a total expenditure of 16,381 kWh. Thus, a mechanical expenditure of 560 therms (heat equivalent), provided 1,562 therms of high-grade useful heat at a

temperature of 135 deg F, giving a ratio of $\frac{\text{heat delivered}}{\text{work expended}}$ "reciprocal thermal efficiency" of 2·8 to 1, i.e., 280 per cent. (The writer considers that the term "co-efficient of performance" is incorrect and quite unsuitable when applied to the heat pump.) Recent improvements in design and operation indicate that this ratio will be improved to 4 : 1, i.e., 400 per cent over the heating season. The smaller the temperature difference, the higher is this ratio, so that the heat pump is most suitable where a low flow temperature is required, e.g., panel-heating systems using flow temperatures of about 120 deg F or even as low as 90 deg F.

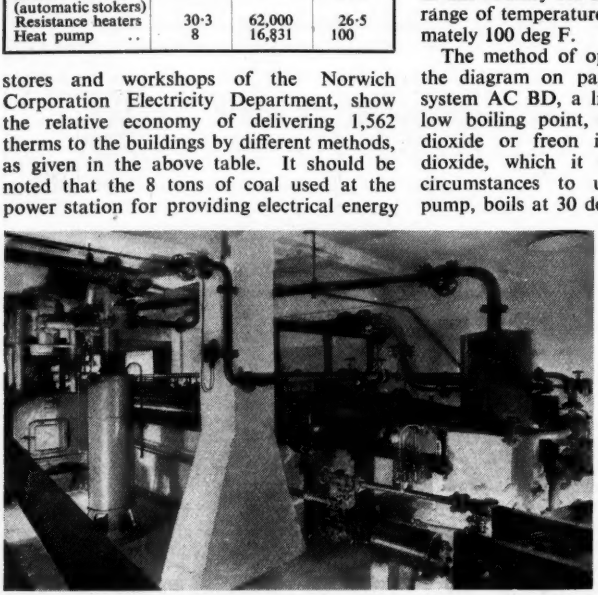
Data derived in respect of the 500,000 cu ft of buildings, comprising the offices, stores and workshops of the Norwich Corporation Electricity Department, show the relative economy of delivering 1,562 therms to the buildings by different methods, as given in the above table. It should be noted that the 8 tons of coal used at the power station for providing electrical energy for the heat pump is of the lowest grade, whereas the 14 tons burned direct is of high quality.

Method of Heating	*Tons of Coal Used*	*Electrical Consumption kWh*	*Relative Efficiency per cent.*
Solid-fuel boilers (automatic stokers)	14	—	57·1
Resistance heaters	30·3	62,000	26·5
Heat pump ..	8	16,831	100

When the office buildings were completed in 1940, the installation of a heat pump was contemplated, but owing to the war situation two coal-fired boilers with automatic stokers were installed temporarily. During the winters of 1940–43, the coal boilers were operated exclusively, but in the following winter an 80-kW electric resistance heater became available and was used for heating the offices only—about 40 per cent of the whole block. In 1944 a second-hand compressor was obtained to form the nucleus of the heat-pump system, which was put together in the Department workshops from sundry or stock materials, and was set to work in 1945. The general design was thus unconventional (e.g., the condenser and evaporator shell were made from 14-in. flanged cast-iron water pipes, each containing 90 condenser tubes) and made no pretence of being the most efficient set-up. This plant was put into operation and the coal-fired boilers shut down in 1945; results so far have been exceedingly promising.

So far as is known, the Norwich heat pump is the first large heat pump to be made in this country for heating a building with a range of temperature (T1 — T2) of approximately 100 deg F.

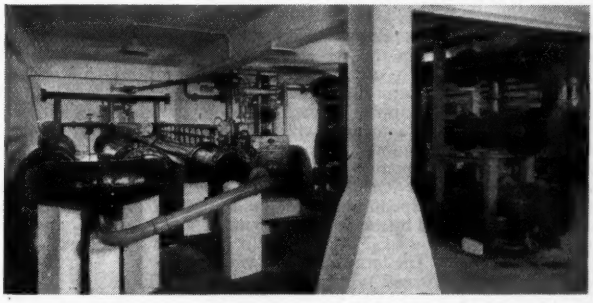
The method of operation is illustrated in the diagram on page 679. In the closed system AC BD, a liquid refrigerant, with a low boiling point, e.g., ammonia, sulphur-dioxide or freon is circulated. Sulphur-dioxide, which it was convenient in the circumstances to use with the Norwich pump, boils at 30 deg F at 22 lb per sq. in. abs. When the refrigerant boils in the evaporator A, the latent heat of evaporation is taken from water which is pumped at, say, 40 deg F and discharged at 38 deg F. The resulting SO_2 vapour containing the abstracted heat is compressed by the compressor C to 150 lb per sq. in., which causes its temperature to rise to 220 deg (as some superheat is obtained). The hot vapour is then liquefied at 135 deg F in the tubes in condenser B and gives up its latent heat of condensation to the water in the building-heating system. The refrigerant is then reduced in pressure on passing through the



View of pump house showing liquid receiver and expansion valve

expansion valve D into the evaporator to repeat the cycle. Freezing of the river supply is prevented by the use of a large quantity of water with a small temperature drop and by placing the intake at a low level since, owing to the phenomenon of maximum density, the water at the lower part of a river which has a frozen surface is always above freezing point.

The compressor is a Brotherhood single-cylinder double-acting machine, twenty years old, which was originally designed as an ammonia compressor for ice-making. It normally runs at 300 r.p.m. and is belt-driven by a d.c. motor, the speed of which can be adjusted, as it was thought (wrongly) that it would be possible in this manner to govern the heat output in this experimental plant.



Lay-out of evaporator and condenser

The question of warming the City Hall by a 500-kW heat pump, as compared with a 1,500-kW electrode boiler, has been under consideration. In addition, new showrooms, to be built on a large site facing the City Hall, would require a 200-kW unit. Further, the heating by the same means of a stores and large printing works owned by a former member of the Electricity Committee has been requested, calling for a further 400-kW plant. To avoid the duplication of several large heat pumps for these purposes, plans and a report have been prepared, which allow for the installation of a large central heat pump immediately at the riverside, with transmission of the heated water from the central heat pump to the buildings mentioned. The capacity of this central plant would not be more than half that of individual pumps, and the cost of providing the water ducts would be very much less than that of transmitting the very much larger amount of river water to them. This project would be, in effect, a district heating scheme using a heat pump to provide the heat. As a reciprocal thermal efficiency of 400 per cent will be obtained, it should compare very favourably with district heating schemes that depend upon heat from a central generating station. Preliminary figures indicate that the proposed central heat-pump scheme is commercially sound and would result in a reasonable annual profit.

Acknowledgment is made of the collaboration in the design and subsequent operation and testing of the Norwich heat pump by many members of the Electricity Department, and particularly by Messrs. A. W. Allwood, Whistler and Nicholls of the undertaking's staff; also to Mr. Chew of L. Sterne & Co., Ltd.

New Philips Publications

A NEW journal, to be called "Philips Research Reports," is to be devoted to the announcement of theoretical and experimental investigations carried out in the company's laboratories at Eindhoven in Holland. It will be obtainable from Philips Lamps, Ltd., Century House, Shaftesbury Avenue, London, W.C.2, in six bi-monthly issues (4s. per copy) forming one volume of about 480 pages yearly; the annual subscription will be one guinea. No. 1, of 64 pages, is attractively presented and printed on good quality paper; it contains four papers on (R 1) the theory of the elastic after-effect and the diffusion of carbon in alpha-iron, (R 2) the current to a positive grid in electron tubes, (R 3) the theory of the stability of lyophobic colloids, and (R 4) the ratio between the horizontal and the vertical electric fields of a vertical antenna of infinitesimal length.

Publication is shortly to be resumed in English of the "Philips Technical Review," devoted to practical applications of research work in the firm's laboratories at Eindhoven in Holland. The journal is illustrated with half-tone pictures as well as line drawings; single copies cost 2s. each including postage, the annual subscription being one guinea for twelve issues, from Philips Lamps, Ltd.

The latest issue deals with "Sintered Glass," explaining how lead-in wires can be fused into glass close to each other; describes "An X-ray Apparatus for Contact Therapy," for treating tumours on the surface of the skin; discusses various methods for "The Measurement of Impedances, particularly on Decimetre Waves"; and describes "An Apparatus for Stroboscopic Observation" and the high-speed photography of motion.

Views on the News

Reflections on Current Topics

THE decision of the Institution of Electrical Engineers to seek more spacious accommodation in the Kingsway Hall for the Kelvin and Faraday Lectures was justified by the attendance at the former last week and will no doubt be again in the second event on May 9th, since both are concerned with atoms, which have naturally made of late a much wider popular appeal. The migration from the I.E.E. lecture theatre will probably be associated in the minds of many with the petition to be presented by the Institution for a Supplemental Charter in order to increase the amount spent on accommodation above that permitted by the Royal Charter of 1921, since when the I.E.E. membership has grown three-fold. The large audience which was this year privileged to hear the Kelvin Lecture enjoyed as lucid and vivid a presentation of a necessarily abstruse subject as I can recall. So far as I could see, Professor Oliphant did not refer to a single note, his delivery appearing to be analogous to a series of intellectual " chain reactions."

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A couple of months ago I drew attention to the possible future homelessness of the Incorporated Municipal Electrical Association. The Association has been given notice of the termination of the lease of its Wellington House offices on July 13th, that is, in just over two months' time. My earlier note on the subject brought forth at least one suggestion, but unfortunately it came to nothing. Mr. J. W. Simpson tells me that they are naturally becoming increasingly anxious and although he realises how difficult accommodation conditions are in London, he still hopes that somebody in the industry will come to the rescue with the offer of premises or a suggestion which will result in the Association's securing somewhere to go to.

* * *

A propos my recent remarks regarding the use of fluorescent lamps as a concealed source of illumination, I was interested to see in the American journal *Electrical Contracting* a number of suggestions as to the way these lamps may be employed in the future. Starting with the outside of the house it is proposed that the number should be illuminated by means of a 6-watt fluorescent lamp. Recessed or semi-recessed circular ceiling units are favoured for hall and living room, the latter having in addition such features as an illuminated mantel, and windows on each side of the fireplace lighted with lamps concealed in valance units. An architectural band on each side wall of the dining room forms part of the decorative motif and conceals the indirect lighting cove, while glass blocks in the wall next to the garage forming an artificial window are lighted to simulate sunlight. An illuminated dining-room cabinet has lamps at top and bottom shining through the glass shelves. Besides a centre fitting 8 ft long and containing four 40-watt lamps, the kitchen has flush lamps over the sink. A continuous metal reflector extending across the headboards of the twin beds is a feature of the bedroom, which also has illuminated panels built into the dressing table mirrors and louvred built-in night-light panels. A circular fluorescent lamp illuminates the shaving mirror.

* * *

Manufacturers of radio and gramophone apparatus have often been accused of stifling public interest in " live " art. It may possibly be true that " ready-made " music fosters the inherent laziness of the masses and it may even by its excellence discourage the amateur who has little hope of reaching the same level. Nevertheless the man who really has music in his soul strives to be an executant. All this leads up to the fact that Mr. R. K. Spencer, of E. K. Cole, Ltd., has proved that some radio manufacturers, at least, are not killers of amateur art by forming a small symphonic orchestra among the company's employees.

* * *

Air travel appears to be rapidly coming popular in the electrical industry as a time-saver. A few weeks ago Alderman Marcus Bloom travelled from West Hartlepool and back in a day to attend an I.M.E.A. meeting. Now I have just come across the following advertisement in the *Scotsman*: —

> " Air pilot required for electrical concern with contracts throughout Britain, must be qualified electrical engineer; preference given to pilot with instructing experience. Reply, in the first instance, by letter, giving full particulars and stating wages required, to Miller & Stables, 16, Northumberland Street, Edinburgh."

Commenting on the advertisement Mr. A. K. Stables, partner of the firm, says his wartime experience in installing electrical devices at R.A.F. stations has made him completely air-minded. The firm has in view the saving of time in travelling long distances when planning and carrying out contracts. Later it may send out squads of skilled workmen to any part of the country.

—REFLECTOR.

Overseas Electrical Trade

Exports Reach Record Value in March

ANOTHER remarkable rise in electrical exports occurred last month. The Board of Trade returns show that the total value of electrical goods and apparatus and machinery exported was over £4 million as compared with not quite £3 million in February and a monthly average of about £1·8 million in 1938. The total for the first quarter of the year was £10·1 million, comparing with £5·4 million as a quarter of the 1938 exports. To complete the comparison and to indicate the rapidity of recovery it may be noted that in the first quarter of last year (which was in the war period) electrical exports had a value of £5·6 million.

With three small exceptions, every item in the March export list (see Table I) was well above the 1938 average. The cable class as a whole accounted for over one million pounds of the total, against a monthly average of £360,000 in 1938. Electrical machinery and the heavier apparatus also contributed largely to the rise with a value of over a million pounds (1938 monthly average £658,000), although there was a fall in switchgear exports; the main increase was in shipments of generators of over 200 kW output. Exports of telegraph and telephone equipment were doubled, cooking and heating apparatus trebled and insulating materials quadrupled. Exports of batteries and accumulators were over three times the 1938 monthly average and X-ray apparatus, etc., over four times.

It will be seen from Table II that the principal customer for electrical goods and apparatus was again South Africa, which

TABLE I.—ELECTRICAL EXPORTS AND IMPORTS

Class	Exports			Imports		
	Mar., 1946	Mar., 1945	Monthly Av., 1938	Mar., 1946	Mar., 1945	Monthly Av., 1938
	£	£	£	£	£	£
Telegraph and telephone wires and cables, submarine	125,984	31,393	17,289	1,374	266,885	31,246
Ditto, not submarine	169,287	45,536	71,803			
Wires and cables other than telephone and telegraph, rubber insulated	230,368	107,055	117,533			
Ditto, insulation other than rubber	492,260	69,240	153,256			
Radio apparatus	339,991	151,461	149,593	16,101	2,132,385	75,160
Telegraph and telephone apparatus other than radio	507,369	213,292	242,716	13,925	240,146	9,243
Electric carbons, furnace	*	*	*	—	6,084	4,054
Other electric carbons	*	*	*	2,864	19,567	2,301
Electric lamps	123,082	50,546	49,440	1,475	28,046	10,265
Other lighting apparatus	130,525	31,467	48,565	849	22,076	38,662
Primary batteries	54,634	8,016	13,572	123	30,235	3,549
Accumulators, portable	101,796	19,879	28,874	*	*	*
Ditto, stationary	13,188	2,509	19,773	*	*	*
Ditto, parts and accessories	38,445	8,899	*	*	*	*
Electric cooking and heating apparatus	92,007	12,101	30,664	*	*	*
Commercial electrical instruments, including ammeters, voltmeters, etc., and parts	41,816	36,749	15,878	3,185	17,212	32,057
House service meters	38,605	4,823	15,791	*	*	*
Other electrical instruments	22,823	5,792	9,612	*	*	*
X-ray apparatus, vacuum tubes and parts	22,481	8,264	4,881	37,030	59,611	9,734
Insulating materials, not elsewhere specified	83,189	15,774	19,343	*	*	*
Unclassified electrical goods and apparatus	223,477	84,117	110,615	6,466	188,783	42,630
Generators, complete, up to 200 kW	36,233	94,302	38,071	*	*	*
Ditto, over 200 kW	384,697	54,115	119,079	*	*	*
Ditto, parts	16,482	—	*	*	*	*
Motors	207,439	153,891	145,045	5,037	2,207	26,033
Convertors and transformers	214,223	87,694	101,304	*	*	*
Rectifiers for power-house use	6,565	4,783	3,463	*	*	*
Motor starting and controlling gear	64,178	17,234	50,866	*	*	*
Switchgear and switchboards other than telegraph or telephone	176,066	214,477	184,533	*	*	*
Other electrical machinery	18,373	188,074	15,497	1,255	141,988	14,455
Electric vacuum cleaners and parts	67,276	404	26,662	78	—	7,519
Other electrically-operated portable appliances	35,295	1,333	10,394	2,375	2,980	17,108
Total	4,078,154	1,723,220	1,814,112	291,137	3,158,205	324,016

* Not separately classified.

took over a seventh of the total; the Union was also responsible for the largest individual purchases of machinery. Australia took second place, with India third and New Zealand fourth. Cables accounted for over a third of Australia's imports from this country and telegraph and telephone apparatus for another third; her machinery imports were about on the 1938 level, in value.

Outstanding among the foreign purchasers of British electrical goods and apparatus were Portugal and France. The returns do not show the classes of equipment responsible for the large shares taken by these countries. They do indicate, however, that shipments to Russia, which were of fairly substantial proportions during the war, dwindled to nothing, due no doubt to navigation difficulties at this time of year. Exports to countries of the Middle East were on a satisfactory level but those to Latin America were disappointingly low. .

Imports, consisting principally of radio, telegraph and telephone, and X-ray equipment, were less than a third of the 1938 average value and a very small fraction of the total for March last year, of which radio apparatus formed two-thirds. The only significant rise as compared with 1938 was in the case of X-ray apparatus.

TABLE II.—DISTRIBUTION OF EXPORTS OF ELECTRICAL GOODS AND APPARATUS

Destination	March, 1946	March, 1945	Monthly Av., 1938
	£	£	£
Eire	116,485	18,320	37,562
Channel Islands	23,739	—	11,965
Palestine	49,691	4,273	8,371
British West Africa	38,611	7,301	12,864
Union of South Africa	388,543	109,936	157,602
Southern Rhodesia	28,717	2,313	9,574
British East Africa	64,198	1,060	7,830
British India	272,615	152,310	122,928
British Malaya	33,637	—	32,280
Ceylon	26,572	4,928	14,931
Hong Kong	10,923	—	12,874
Australia	344,581	214,204	196,823
New Zealand	163,444	50,917	96,851
Canada	12,194	24,243	12,482
British West Indies	19,280	18,436	12,887
Other British Countries	87,108	27,227	26,336
Soviet Union	—	189,838	36,780
Finland	48,176	—	5,824
Sweden	39,226	5,017	13,735
Norway	89,073	—	12,582
Denmark	56,633	—	18,282
Poland	335	—	9,626
Netherlands	72,852	—	20,190
Belgium	59,118	147	10,874
France	130,289	6,570	15,674
French West and Equatorial Africa	3,306	177	400
Switzerland	10,690	734	3,572
Portugal	148,355	3,099	6,498
Portuguese East Africa	14,341	10,036	6,924
Spain	24,127	111	3,808
Italy	3,528	1,282	5,659
Czechoslovakia	1,686	—	7,205
Yugoslavia	4,365	—	1,471
Greece	1,346	—	4,888
Roumania	—	—	13,350
Turkey	61,451	504	7,633
Egypt	65,155	7,318	12,872
Iraq	27,914	4,931	5,456
Iran	71,920	5,877	16,330
China	11,267	3,251	4,042
United States of America	6,899	6,986	5,546
Chile	1,714	178	6,635
Brazil	19,776	158	11,123
Argentine Republic	67,641	4,924	45,387
Other Foreign Countries	129,806	20,307	33,672
Total	2,851,327	906,913	1,119,198

Income Tax Allowances

THREE explanatory pamphlets have been issued by the Board of Inland Revenue dealing with the question of allowances under recent income tax legislation. The first (No. 410) relates to allowances for industrial buildings which came into effect on April 6th for the financial year 1946-47 and onwards. These allowances grant relief from income tax within a period of fifty years in respect of capital expenditure incurred after April 5th, 1946, on the construction of industrial buildings or structures. There is an initial allowance equal to 10 per cent of such expenditure and an annual allowance during continued industrial use of the building equal to 2 per cent of the expenditure. Provision is made for a balancing allowance if a building is scrapped, sold or destroyed within the fifty-year period. The system applies to expenditure incurred less than fifty years before April 6th, 1946, but no initial allowance will be given in respect of expenditure incurred before April 6th, 1944. The pamphlet gives guidance regarding the buildings to which the allowances apply, persons who may claim the allowances, qualifying expenditure, etc., and examples are given of methods of assessing the allowances.

Pamphlet No. 430 deals with allowances for machinery or plant as from April 6th, 1946, including the important changes made by the Income Tax Act, 1945. The system provides for an initial allowance when machinery or plant is bought, for annual wear and tear allowances while it is used and for a balancing allowance when it is scrapped, sold or destroyed. It is shown who may claim these allowances and the terms "machinery or plant" and "capital expenditure" are defined. It is noted that in certain cases allowances may be claimed by persons who have let or hired machinery or plant for business purposes. Examples of the operation of the system are given.

The third pamphlet (No. 490) explains the main features of the income tax law and practice in operation with effect from April 6th, 1946, with regard to (*a*) allowances in respect of expenditure on patent rights; and (*b*) the taxation of sums received in respect of such rights.

I.E.E. Meeting

Presentations and the Kelvin Lecture

TO accommodate the large attendance of members of the Institution of Electrical Engineers to hear the 37th Kelvin Lecture on April 26th, the meeting was held at the Kingsway Hall. The President (DR. P. DUNSHEATH) was in the chair and opened the proceedings by the presentation of a certificate of honorary membership of the I.E.E. to the Earl of Mount Edgcumbe.

Dr. Dunsheath said the Council was thus recognizing his distinguished work as an electrical engineer, and the services rendered by him to the Institution. He recalled that Lord Mount Edgcumbe served his pupilage with Crompton & Co. at Chelmsford and in 1897 joined the staff of the Northampton Polytechnic Institute, London. In 1900 he founded the firm of Everett, Edgcumbe & Co., Ltd., of which he is now managing director and chairman. After referring to Lord Edgcumbe's service in the Territorial Army, Dr. Dunsheath said he joined the Institution in 1897 as an associate and became a member in 1905; he served on the Council from 1922 to 1925 and as vice-president from 1925 to 1928, and was President in 1928-29. For papers read before the Institution he had received the Ayrton and the Silvanus Thompson premiums. It was in his year of office that the Meter and Instrument Section of the Institution (now the Measurements Section) was formed. He was largely instrumental in the inauguration of a scheme for the periodical publication of "Progress Reviews" in the *Journal*. In his capacity as honorary secretary of the International Electro-Technical Commission he had made valuable contributions.

LORD MOUNT EDGCUMBE expressing his appreciation of the honour, said that in the 'nineties they were out to show they were engineers and were no longer on the leading strings of the physicist. To-day they were going to listen to a lecture from a pure physicist. The great honour that had been conferred upon him by the Institution would make it very much easier for him to "climb on to the shelf."

Presentations at the Meeting

(Left to right) Sir Edward Appleton, Mr. W. K. Brasher (secy.), Dr. P. Dunsheath, and the Earl of Mount Edgcumbe, acknowledging his certificate of honorary membership

The President then presented the 24th Faraday Medal to Sir Edward Appleton for the conspicuous services rendered by him in the advancement of electrical science, particularly in the field of radio propagation. He stated that Sir Edward was educated at Bradford and St. John's College, Cambridge, and after serving throughout the 1914-18 war he returned to Cambridge as assistant demonstrator in experimental physics in the Cavendish Laboratory and two years later became Sub-lector of Trinity College. From 1924-36 Sir Edward occupied the Wheatstone Chair of Physics in the University of London and during the next three years was Jacksonian Professor of Natural Philosophy at Cambridge. He was now Secretary of the Department of Scientific and Industrial Research.

During this eventful life, Sir Edward had written many original papers on electricity and the scientific problems of wireless communication. His early researches in connection with the propagation of radio waves, and particularly on their reflection and

refraction, had been of fundamental importance in the development of radiolocation and in acknowledgment of his work and discoveries his name was given by his colleagues to an ionospheric layer. In his capacity of Secretary of the Department of Scientific and Industrial Research, his inspiration and guidance of the use of science in many fields of national activity had been a major factor in the success of the scientific effort of this country.

SIR EDWARD APPLETON said that his deep appreciation of this honour was enhanced by the fact that on a previous occasion the Kelvin Medal had been awarded to his old professor and teacher, Sir J. J. Thomson, and also to Oliver Heaviside, upon whose theory was founded so many of his own efforts. He thanked the Institution for all it had done and was doing for radio science.

Kelvin Lecture

The President introducing the Kelvin lecturer for this year, said that Professor M. L. Oliphant, F.R.S., was a distinguished physicist who, since 1937, had been Poynting Professor of Physics in the University of Birmingham. He was born in South Australia, received his education at the University of Adelaide, and later at Trinity College, Cambridge. He became a fellow and lecturer at St. John's College in 1934 and was appointed assistant director of research at the Cavendish Laboratory, Cambridge, in 1935. Professor Oliphant was a leading member of the British team which worked on the development of the atomic bomb.

PROFESSOR OLIPHANT, whose lecture bore the title " Nuclear Physics and the Future," said there were now available sources of heat energy which could be used, when released rapidly, as an explosive, or as a source of power if they were released, as they could be, in any easily controllable way. Weight for weight they were three million times as effective as coal as a source of energy, or 30 million times as effective as coal, volume for volume.

The speaker said it was early realized that radioactive phenomena were associated with the actual break-up of the atom, with a change of the atoms from one form to another, and that in the process they actually threw a bit of themselves (a piece of matter) out, in the form of alpha rays, or the helium atom, or beta rays, or negative electrons. Those particles of radiation were emitted with enormous energy, of the order of one million times greater than the energies associated with chemical change.

Increased knowledge of the atom had come about almost entirely as the result of the development of new techniques; insufficient credit had been given to those who made possible the discoveries of the scientist by providing apparatus suitable for the purpose. One of the first such individuals was C. T. R. Wilson, who developed the expansion chamber, which had played a very important part in enabling practical use to be made of the knowledge possessed about atomic nuclei.

Rutherford's Work

It was Rutherford who introduced the method of investigating what took place inside an atom by projecting alpha particles into it and from the knowledge so gained he was able to calculate a very great deal about what took place inside the atom itself. Practically every important discovery was made in Rutherford's laboratory either by himself or his students. The Rutherford-Bohr model of the atom still persisted in spite of the increase in the exact knowledge of the way the atom was built up.

But great advances were not made until sources for artificially accelerating the particles were found. The first experiments of this nature were carried out by Cockcroft and Walton based on the work of Allibone. At about the same time there was developed in America another method of accelerating particles which involved, indirectly, the cyclotron, which was now made in very large sizes. One of the slides shown illustrated the gigantic cyclotron which was used by Lawrence during the war for the separation of isotopes. It had a gap of about 6 ft and a magnetic field of 15,000 gauss; it was destined to play a big part in the nuclear physics of the future.

Professor Oliphant demonstrated electrical methods of hearing atoms explode with the aid of a loud speaker and oscillograph with a small piece of pollonium. He also demonstrated how the Geiger counter was used to detect beta particles or gamma rays.

The object of these experiments was to show that we now had means for detecting single atoms of matter provided they underwent radio active change. The lecturer showed diagrammatically what happened when a collision took place and explained the electron-volt, which represented the energy release.

Professor Oliphant traced the theoretical

development of this work through in some detail and showed how a chain reaction could be obtained, which made possible the practical application of nuclear energy. Speaking more generally, he said it was now possible to have an atomic bomb of extremely small size (American literature had referred to one of grapefruit size) which could release energy equivalent to that which could be released by 20,000 tons of T.N.T., which was the best of the normal explosives.

Wasting Energy

Having shown some slides of the experimental explosion of atomic bombs during the work carried out in America, he turned to the uses which could be made of nuclear energy for peaceful purposes in the future. At the present time the Americans had in the State of Washington enormous graphite piles producing energy at the rate of one million kW or more, which were just warming up the waters of the Columbia River because the primary purpose was to manufacture plutonium out of which atomic bombs could be made equally with uranium. Both of these substances could be used as a source of industrial energy provided we could overcome the difficulties of corrosion of uranium and find some way of safely raising the temperature to 600 or 1,000 deg C, then we could either produce high pressure steam or drive gas turbines with gas which had been compressed with the power available.

It was purely an engineering matter to succeed in utilizing nuclear energy. There were certain difficulties, but they would be overcome if the necessary stimulus were given. At one extreme was the small atomic bomb and at the other large power plants. At present the need for protection many feet in thickness would render mobile plants possible only in large ships or submarines, since it would eliminate almost completely the problem of fuelling, 1 lb of uranium being the equivalent of 1,500 tons of other fuel. He was unable to see at the moment how it would be possible to use atomic energy for such purposes as aircraft or motor cars because it would be a little difficult to have a 7-ft concrete wall between the driver and the engine!

At the present moment it was the military problem which stood right in the path of advance in other directions, because in endeavouring to produce energy one would inevitably produce plutonium, which could be used to make atomic bombs. Therefore, nobody could be allowed to have a plant for this purpose until the military and political problem had been solved.

Recently in the United States there had been published the Lilienthal Report which made some very constructive proposals which might enable U.N.O. to decide to control atomic energy and yet leave it possible to develop such energy for its proper uses. It might be possible to de-nature plutonium or uranium to render it impossible to make bombs; there were suggestions on that matter in this report.

From the point of view of economics, if we found it possible to transform the whole of uranium 238 into plutonium, even if we transformed a million tons, the cost of fuel would be negligible, but at the present time we were not quite sure whether it was possible to do this. But if we utilized uranium 235, which was 1/140th of the uranium available, the effectiveness of uranium as a fuel was still enormous from the point of view of energy production. Some people were confident that we could use the whole of uranium 238, or use some substitute such as thorium which, in certain circumstances, could be used for producing atomic energy. Thus, economically, the cost of fuel was unlikely to be an important matter if it were possible to process and control it. However, the plants necessary to de-nature it would be very elaborate and it might be that in the end we should not have a fuel that would compare favourably with oil, coal or water power. It was a question of fitting our new energy into our new economy. The attempt at first would have to be in large power stations and the energy would be distributed in a convenient way through electrical mains.

World Power Supply

It had been said in America there was enough uranium in the world to supply all the world power plants, if we changed over to nuclear energy, for something of the order of 100 years. He did not know how true that was, but it could confidently be reckoned that in that time we should learn how to get nuclear energy by a different process. The sun took hydrogen and, it was believed, changed it by a series of processes into oxygen and released energy which was very much bigger than that obtainable from uranium. This class of nuclear reaction might turn out, in the distant future, to be the source of energy which the world made use of.

On the motion of SIR ARTHUR FLEMING, seconded by MR. T. G. N. HALDANE, a vote of thanks was accorded to Professor Oliphant.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AS announced last week, **Mr. R. W. S. Mackay,** sales manager of the Midland Electric Manufacturing Co., Ltd., and **Mr. A. T. Hesmondhalgh,** secretary, whose portraits we reproduce, have been appointed directors of the company.

Mr. R. W. S. Mackay

Mr. A. T. Hesmondhalgh

As a result of the entrance scholarships held at the Faraday House Engineering College on March 27th to 29th, J. A. Green (Stockton Secondary School) has been awarded the "Faraday" Scholarship of 60 guineas a year for two years, and J. A. Mayhew (Kingston Grammar School), the "Maxwell" Scholarship of 60 guineas a year for two years. Exhibitions of the value of 20 guineas a year for two years have been awarded to: D. C. J. Thorogood (Coopers' Company's School); and A. D. B. Barkwith (Beckenham & Penge County School).

Sir Frank Newson-Smith, Bt., has been nominated as the new president of the London Chamber of Commerce. Sir Frank, who is a stockbroker, was Lord Mayor of London in 1943-4.

Mr. W. F. Barker, chief income assistant, Heston and Isleworth Borough Council, has been appointed principal assistant, Finance Department, London and Home Counties J.E.A.

Mr. J. S. Bartlett has been appointed assistant shift charge engineer at Southwick power station, Brighton. For the position of assistant mains development engineer the Electricity Committee has selected **Mr. R. W. Collings.**

Mr. and Mrs. H. F. Truman, were entertained at a dinner at the Masonic Hall, Walsall, on April 17th to celebrate their silver wedding and the silver jubilee of the Truman Electrical Co. Their son, Mr. Donald Truman, who is serving with the R.A.F., presided over a company of about one hundred, which included a number of employees. Proposing a toast to the "Truman Electrical Co." Mr. E. A. Newburn, engineer and manager of Walsall Electric Supply Department, said that in the interests of the consumer it was essential that the private contractor and the municipal supply undertaking should work together. The toast was seconded by the Mayor of Walsall (Councillor M. J. Kavanagh) and Mr. Truman responded.

During the evening **Mr. C. C. Lavis** was presented with a gold watch in appreciation of his twenty-five years' service with the firm, and he in turn presented Mr. Truman with a silver syphon holder on behalf of the employees.

Mr. A. E. Marchant, borough electrical engineer and manager of Barking, was married last Saturday to Miss E. L. Catchpole at St. Margaret's Church, Barking.

Lord Forrester, managing director of Enfield Cables, Ltd., and **Mr. L. A. Booth,** sales director, have now arrived home after their aerial visit to Australia and New Zealand.

Mr. A. H. Bent, manager of the transformer sales department of the English Electric Co., Ltd., Stafford, has been elected chairman of the Wolverhampton branch of the Institute of Welding. He was unable to assume his new office at the first annual meeting of the Branch held recently as he is with an industrial investigation team in Germany.

Mr. Norman Ashton, A.M.I.E.E., M.Inst.F., who, as announced in our April 19th issue, has been appointed electrical engineer and manager of the Spenborough U.D.C. Electricity Department, received his technical training at the Royal Technical College, Salford, and served his apprenticeship with Switchgear & Cowans, Ltd., later holding appointments with Salford Electrical Instruments, Ltd., the Metropolitan - Vickers Electrical Co., Ltd., and the Salford Electricity Department. He was appointed to the post of electrical engineer and manager to the Brierfield U.D.C. in 1940, when consumers' engineer to the Eccles Corporation Electricity Department.

Mr. N. Ashton

Mr. A. H. Marston, mains assistant to the Hammersmith Borough Council Electricity Department, has been appointed mains engineer to the Bridlington Electricity Department. After serving his apprenticeship with the Coventry Corporation Electricity Department from 1923 to 1928, Mr. Marston was appointed junior mains engineer. He left Coventry in 1930 to become assistant mains engineer at Derby. From 1939 to 1941, when he went to

Hammersmith, he served as technical engineer at the Leeds office of the British Thomson-Houston Co., Ltd.

The Hon. Alexander Campbell Geddes, O.B.E., M.C., B.Sc.(Lond.), has been appointed to the boards of the Brush Electrical Engineering Co., Ltd., Petters, Ltd., and Oil Engines (Coventry), Ltd.

Mr. S. F. Osborne, A.M.I.E.E., A.C.I.S., who, as reported in the *Electrical Review* of April 19th, has been appointed by the London & Home Counties J.E.A. as district officer at Twickenham, is at present technical assistant with the British Standards Institution. Before joining the B.S.I. in 1944 Mr. Osborne was for seven years with the Yorkshire Electric Power Co., being district manager of the north-west and north-east districts from 1939 to 1944. His previous appointments included consumers' engineer at Ealing, development assistant with the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Co., and in the contracts departments of several electrical manufacturing companies. He received his technical training at the Regent Street Polytechnic and Manchester College of Technology and his engineering training with the English Electric Co., Stafford. He has contributed a number of articles to the *Electrical Review* on matters relating to the development of electricity supplies and the design of electrical apparatus.

Mr. S. F. Osborne

Mr. H. A. A. Beale, A.M.I.E.E., has left the South East England transmission staff of the Central Electricity Board to join the English Electric Co., Ltd., in charge of its Bedford office. He was educated at Wellington and spent two years with the Bedford Corporation Electricity Department, before receiving his works training as a student with W. H. Allen, Sons & Co., Ltd. Following this he became an assistant engineer in the outside contract department of the B.I. Cables, Ltd., and he joined the staff of the C.E.B. at Bedford six years later, in 1937.

Mr. Hugh M. Steel, director of the Scottish Co-operative Wholesale Society, has been appointed vice-chairman of the British Luma Electric Lamp Society.

On retiring from the service of the Brookhirst Switchgear, Ltd., after forty years, **Mr. W. Walter Lea,** has been presented with a cheque for one hundred guineas by the directors of the company. In addition to the cheque, Mr. Lea was presented with a pair of cuff-links sent by a Service colleague from Egypt and Mrs. Lea was presented with an electric table lamp.

Mr. Watson Smyth has been appointed generation engineer of the Lancashire Electric Power Co., succeeding **Mr. M. H. Adams** who, as already announced, has been appointed chief engineer and manager of the company. Mr. Watson Smyth joined the company's generation department as test engineer in 1930 and was made deputy generation engineer in January last year. Consequent upon his appointment as secretary and assistant manager, **Mr. S. M. Rix** has relinquished the position of accountant to the company, and the directors have appointed **Mr. V. T. T. Atkinson,** A.I.A.C., to the position in which he will be directly responsible to the secretary. Mr. Atkinson joined the company in 1907 and was appointed assistant accountant in 1936.

Mr. H. V. Emptage, public lighting superintendent at Margate, whose extended service was to expire on May 19th, has been re-engaged for a further period of one year.

Mr. G. F. Gregory, borough electrical engineer of Ilford, is to retire owing to ill-health.

Mr. H. C. Maxwell has been appointed a director of the Ebonite Container Co., Ltd.

Mr. Russell Taylor, Salisbury, has been appointed mains assistant in the Rawtenstall Corporation Electricity Department.

The Hammersmith Borough Council has confirmed the appointment of **Mr. John Brocklebank,** A.M.I.E.E., as deputy electrical engineer, to succeed Mr. B. L. Wells, B.Sc., M.I.E.E., who, as previously reported, was appointed to the position of chief engineer to the undertaking in January last. Mr. Brocklebank received his training at York Corporation Electricity Department, to which undertaking he returned as assistant mains superintendent after holding appointments with the Scarborough Electric Supply Co. Joining the staff of the Yorkshire Electric Power Co. he was district engineer in the Wharfedale area when appointed to Hammersmith. He has held various appointments during his long association with this undertaking, and since 1940 has been mains superintendent in charge of the entire distribution system.

Mr. J. Brocklebank

E. H. Jones (Machine Tools), Ltd., announce the following appointments to their sales organization: Manager, Southern area, including London and Bristol, Mr. W. F. Wright; manager, Midlands, Mr. Bowen, operating from Birmingham; manager, Lancashire and Yorkshire area, including North Wales, Mr. F. A. Young, operating from Manchester; manager,

Scotland and Northern Ireland, Mr. R. Black, operating from Glasgow.

Mr. H. W. Adams has been appointed export manager of the General Electric Co., Ltd., in succession to Mr. E. W. Hann, who recently retired after fifty years' service with the company. Mr. Adams has been with the G.E.C. thirty-six years and during the whole of that time has been concerned with the development of the company's export trade, first as an export sales engineer and subsequently as export sales manager. He has been described as "the most travelled traveller in the G.E.C.", having toured the world and visited forty countries in the quest for export trade. **Mr. F. C. Smith** has been appointed manager of the company's Despatch and Packing Departments following the retirement of Mr. C. E. Haken. Mr. Smith's place as manager of the Invoice Department will be taken by **Mr. W. G. Batt.**

Mr. H. W. Adams

Mr. L. Stokes-Roberts, of the Strand Electric & Engineering Co., Ltd., has been elected a governor and member of the Executive Council of the Shakespeare Memorial Theatre, Stratford-on-Avon. Mr. Stokes-Roberts, who is twenty-seven, was (until his recent demobilization in the rank of lieutenant-colonel) in charge of "live" entertainment for troops in SEAC.

The Birmingham Electric Club has arranged a golf competition on May 21st at Walmley Golf Club. It is also proposed to hold the final of the snooker handicap on the same evening.

Mr. P. Philip, Dundee city electrical engineer, has been appointed chairman of the Scottish Centre of the Institution of Electrical Engineers for the 1946-47 session.

Mr. C. A. Cheyne, having been granted release from his post as Assistant Director of Aircraft Production Factories has joined N. G. Bailey & Co., Ltd., electrical contractors, as their London technical sales director. Mr. Cheyne served his apprenticeship with the General Electric Co., Ltd., at Witton, and remained with the company until his appointment with the M.A.P.

Mr. Charles Smith, engineering assistant to the Liverpool Corporation Electric Supply Department is recommended for the position of deputy city lighting engineer at a salary of £700 a year.

Mr. W. Tomlin has recently been appointed works manager to the Harland Engineering Co., Ltd. in place of Mr. F. Dutton who is leaving the company to enter into business on his own account. Mr. Tomlin was, until recently, works manager to Ruston-Bucyrus, Ltd.

Appointments Vacant.—In this issue the Wallasey County Borough Council is advertising for a borough electrical engineer and manager to succeed Mr. R. C. Golding, who has been appointed to Southend. Deputy engineers and managers are required by the Ilford and Islington Borough Councils.

Obituary

Mr. F. H. Sharpe.—The death occurred recently of Mr. F. H. Sharpe, assistant service manager of Hoover, Ltd., who had been in ill-health for the last few years. He had been with the company since 1920.

Mr. N. Porter.—The death has occurred at Jesmond, Newcastle-on-Tyne, of Mr. Norman Porter, managing director of Watson-Norie, Ltd., electrical contractors. He was forty-seven years of age.

Will.—Mr. James Watt, LL.D., W.S., of Edinburgh, chairman of Bruce Peebles & Co., electrical engineers, who died on December 3rd last, left personal estate in England and Scotland valued at £218,455.

Ignition-System Faults

Method of Diagnosis

AN instrument for diagnosing faults in the ignition system of internal combustion engines while they are running is described in a paper presented by MR. F. R. F. RAMSAY (D. Napier & Son, Ltd.) and MR. W. NETHERCOT (Electrical Research Association) to a joint meeting last week of the Measurements Section of the Institution of Electrical Engineers with the Internal Combustion Engine Group of the Institution of Mechanical Engineers.

The method is to tap off a negligible quantity of energy from one sparking plug of the engine so that its performance may be studied pictorially by viewing a row of stationary figures (each corresponding to one spark plug) on the screen of a small cathode-ray oscilloscope, the shape of each figure suggesting the nature of the fault.

The outfit (see *Electrical Review*, July 20th, 1945, p. 103) is manufactured by the English Electric Co., Ltd., being widely utilized for servicing engines in military equipment. The instrument is contained in a metal box 15½ in. by 8½ in. by 11½ in. in size. It may be energized from 230 V a.c. mains, or through a multi-winding transformer with vibrator from 6, 12 or 24-V batteries, a rotary selector switch being provided.

I.E.E. Annual Report and Accounts.—Copies of the annual report of the Council of the Institution of Electrical Engineers for the 1945-46 session and of the accounts for the year ended December 31st, 1945, to be presented at the annual general meeting on May 9th, can now be obtained by members of the Institution on application to the secretary.

Cable and Wireless

Terms of Nationalization

LAST week the text was issued of the Cable and Wireless Bill which is designed to bring the share capital of Cable & Wireless, Ltd., into public ownership. With it was published a White Paper (Cmd: 6805, Stationery Office, 2d.) which sets out the history of the organization, its operations, and the recommendations of the Commonwealth Communications Council and Conference.

Briefly these recommendations were that the respective Governments should acquire the shares of the telecommunication companies operating in their territories and establish a Commonwealth Telecommunications Board to formulate policy and co-ordinate the services, research, etc. The recommendations were accepted and the United Kingdom Government is now introducing legislation to enable it to acquire the shares of Cable & Wireless, Ltd., and compensate the present holders.

The Bill provides for the issue to the shareholders of Government stock, the amount being agreed between the company and the Treasury; there is provision for arbitration in default of agreement.

In a statement issued by Cable & Wireless, Ltd., the opinion is repeated that the proposed scheme is unworkable and impracticable and dangerous to the company's foreign concessions. It is pointed out that at no time has there been any criticism of the company's efficiency and that it had no say in the preparation of the various reports on the subject. An inquiry by a Royal Commission should be held before any irrevocable step is taken.

Building Materials

Ministry's Allocation Scheme

ON April 25th the Ministry of Works introduced a scheme to ensure that building materials and equipment which are scarce are allocated in accordance with the importance of work to the Government housing scheme or of equivalent urgency. The plan involves the use of " priority symbols " which will indicate to manufacturers and merchants the order in which they should meet demands for materials.

The priority symbol will consist of the name of the licensing authority followed by the letters " W.B.A." and an identifying number. These letters are already in use to signify priority for work including the erection of and site preparation for houses, flats and other dwellings; the rebuilding of " cost of works " payment houses; the repair of C (b) houses on a lump sum or fixed fee basis; and any other work resulting in an increase in housing accommodation; but not war damage repair work to a house already occupied which does not increase the amount of housing accommodation. This priority is also granted to a limited number of other essential projects, e.g., work on essential public utilities and factories.

Contractors will be able to quote a symbol only against the quantities of materials and components required for priority work and they will be called upon to declare that they have not quoted priority symbols for orders in excess of the authorized quantities; they may not place the same priority order with more than one supplier.

The Government Departments concerned are discussing with manufacturers means of spreading the load of priority orders evenly over the available capacity of their industries.

There are four forms of priority certificate. Form " A " covers structural materials. " B " is for electrical and gas equipment and includes ceiling blocks, ceiling roses, fires, immersion heaters, lampholders, plugs and sockets, switches, switchboxes and fuses, thermostats, wash-boilers, water heaters, conduit boxes and cable. " C " applies to sanitary fittings and miscellaneous equipment. " D " relates to solid fuel appliances, iron castings and miscellaneous material, including electrical conduit.

Electrical Manufacture in Eire

OUR Dublin correspondent has supplemented the note published in last week's issue regarding the formation of a company in Eire (capital £500,000) to manufacture electrical equipment. He says that the company is stated to be closely linked up with the Government's electrical enterprises as well as with plans for the coming development of Coras Iompair Eireann (C.I.E.) the transport monopoly company which, backed by State funds, has absorbed the railways, including the Great Southern Railway Co. and the Dublin tram and bus services. The company will not only produce electrical plant but manufacture electric rolling stock for the C.I.E. Associated with Mr. Alan Good and his brother, Mr. William Good is Mr. Thomas Hogan, formerly a member of the staff of the Irish Electricity Supply Board. Mr. Hogan was connected with Continental electrical engineering establishments before becoming chief engineer of Siemens Schuckert (Ireland), Ltd.

The programme of the C.I.E. for future development envisages, it is stated, a complete conversion from steam to Diesel-electric traction. It has been announced that the Brush Electrical Engineering Co., which will be financially interested in the company in course of formation, has already secured orders for Diesel-electric locomotives.

The company will begin with the manufacture of transformers and house meters for the Electricity Supply Board. The latter will (as its " Report on Rural Electrification " revealed) require up to 100,000 pole transformers, costing about £30 each if the 400,000 rural dwellings in Eire are supplied by the

turf and water power schemes. A more likely conservative estimate is that at least 50,000 to 65,000 transformers will be needed, mainly of the pole type but including larger 38/10-kV transformers. Any surplus after meeting Irish requirements would be available for exportation to Great Britain and the Empire. The company is also expected to embark on the production of transmission lines (approximate needs cover 50,000 miles). For the export trade the contemplated equipment includes small motors for farms, industrial switchgear, and various domestic appliances.

Forthcoming Events

Saturday, May 4th.—*Manchester.*—Engineers' Club, Albert Square, 2.30 p.m. I.E.E. North-Western Students' Section. Annual general meeting.

Monday, May 6th.—*London.*—Institution of Electrical Engineers, 7 p.m. I.E.E. London Students' Section. Ordinary meeting. "D.C. Control Equipments on British Motor Coach Trains," by B. J. Prigmore.

Tuesday, May 7th. — *Leeds.* — Corporation Electricity Department, 6 p.m. I.E.E. North Midland Centre. Annual general meeting.

Manchester.—Engineers' Club, Albert Square, 6 p.m. I.E.E. North-Western Centre. Annual general meeting. "Silicon Carbide Non-ohmic Resistors," by F. Ashworth, W. Needham and R. W. Sillars.

Tuesday, May 7th to Thursday, May 9th.—*Birmingham.*—Imperial Hotel. The Electrodepositors' Technical Society. Annual conference.

Wednesday, May 8th.—*Sheffield.*—Royal Victoria Hotel, 7.30 p.m. Association of Supervising Electrical Engineers (Sheffield Branch). "The H.R.C. Fuse and its place in Industrial A.C. Systems," by R. T. Lythall.

London.—Institution of Electrical Engineers, 5.30 p.m. I.E.E. Transmission Section. "The Evolution of the French Transmission Network," by P. M. J. Ailleret.

Thursday, May 9th. — *London.* — Kingsway Hall, 6.30 p.m. Faraday Lecture, "Atoms, Electrons and Engineers," by Dr. T. E. Allibone.

Friday, May 10th. — *London.* — The Royal Institution, 21, Albemarle Street, 5.15 p.m. "Sunspots, Radio-Fading and Radio Noise," by Sir Harold Spencer Jones.

Connaught Rooms, W.C.2, 10 a.m. Electrical Association for Women. Twenty-first annual conference.

St. Stephen's Tavern, Bridge Street, Westminster, 6.30 p.m. Electrical Power Engineers' Association. "Stroboscopic Testing as Applied to Electricity Meters," by H. E. Angold.

Newcastle-on-Tyne.—Neville Hall, 6.30 p.m. I.E.E. North-Eastern Students' Section. Annual general meeting and film show.

Bristol.—I.E.E. Bristol Students' Section. Visit to Broadcasting House, Whiteladies Road.

Tuesday, May 14th, to Friday, May 17th.—*London.*—Institution of Electrical Engineers. Convention of the Illuminating Engineering Society.

Correspondence

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Reinforced Concrete Poles

IN his article in your issue of April 12th Mr. H. F. Lidster says:—"Unfortunately home-grown timber is poor, bad in shape and variable in quality and condition, and has a short life, often not exceeding ten years." In my opinion Mr. Lidster's statements are far too sweeping and unfair to the home-grown pole, and in view of the big afforestation schemes which will be starting shortly, and the supply of poles which these will ultimately provide, I think his remarks call for a reply.

Undoubtedly the forests in this country are small in comparison with those abroad. Nevertheless the G.P.O. has taken supplies of native poles ever since it started erecting telephone lines, and it is obvious it would not accept poles as described by Mr. Lidster.

The number of home-grown poles supplied over the last six years has been amazing, and very few people expected that the requirements of the country could be kept going for six years on these alone. As a consequence of the intensive search for poles they are now very scarce, and poles which would not have been considered before the war have now to be taken, but Mr. Lidster should not condemn home-grown poles simply because an enormous and unexpected demand has made them scarce and difficult to get, and brought into use poles of a lower standard and shape than pre-war. The buyers were often unable to wait for the poles to be properly seasoned, and in such cases the life, of course, will be disappointing, but where the poles have been properly seasoned before being creosoted there is no reason why their life should not be equal to that of the imported pole.

Larbert, Stirlingshire. D. C. LEITH,
General Manager,
James Jones & Sons, Ltd.

Supervisory Staffs.—Mr. Herbert Morrison is to be the principal speaker at a public meeting to be held by the Association of Supervisory Staffs and Engineering Technicians on May 21st at the Central Hall, Westminster, in connection with the Government's drive for securing maximum production. The Association has just issued a memorandum on the Government report on higher appointments entitled "Managers, Supervisors, Technicians—Your Future and Status." It is obtainable, price 9d., from the Association's offices, 150, Southampton Row, London, W.C.1.

Small Generating Sets

Design and Testing Requirements

By "Works Engineer"

TESTS of engine-driven generators must be of sufficient duration to allow time for any faults to become evident, and, as far as practicable, should be carried out under working conditions, e.g., as when required for use in the tropics with ambient temperatures of 113 to 120 deg F. The driving unit must have enough margin of power to provide for all demands under the most onerous circumstances, allowing for a generator efficiency of perhaps only 85 per cent or less. Care should be taken to ascertain whether manufacturers' curves refer to the bare power unit or whether they include all auxiliaries. The generator may be totally enclosed or merely drip-proof; the ordinary "protected" generator is not to be recommended unless the plant is installed in a proper engine-room and can be given skilled attention and maintenance.

Although a generator may have been subjected to heat-run and load tests at the maker's works, its satisfactory performance when driven by its own prime mover may need to be established by test on site to ensure that a pre-determined temperature rise is not exceeded under working conditions. For tropical conditions it is often stated that machines shall comply with B.S.S. 168 except that the temperature rise shall be 10 deg C less than is prescribed.

Temperature Rise

Under B.S. 1156—a war-emergency specification that applies to motors and generators up to 300 kVA for voltages not exceeding 660, but excluding fractional horse-power machines—the temperature rise and total temperature must not exceed 45 and 85 deg C for open or protected machines and 55 and 95 deg C for totally enclosed machines, the cooling air in each case being at 40 deg C. If the cooling air exceeds 40 deg, the permissible temperature rise is reduced so that the total temperature shall not exceed the stated figures. The foregoing limiting temperatures must not be exceeded when the machine is driven by its own prime mover *under the ventilating conditions which will apply in service.*

Thermometers should, if possible, be affixed to windings so that periodical readings may be taken and a heating curve plotted until the rate of heat generation equals the rate of heat dissipation, when the temperatures will remain constant.

Temperature rise can also be determined by the increase in the resistance of the winding itself, but this method measures only the average temperature rise of the whole winding as contrasted with the temperature at the surface or other isolated point. The hot temperature can be deduced from the following formula $\frac{R_2}{R_1} = \frac{T_2 \text{ deg C} + 234{\cdot}5}{T_1 \text{ deg C} + 234{\cdot}5}$ where T_2 = hot temperature, T_1 = cold temperature, R_1 = cold resistance and R_2 = hot resistance.

Speed Measurements

For speed measurements the tachometer commonly used is the ordinary "Hasler" or similar type provided with a metal or rubber spear for holding against a "V" in the centre of the revolving shaft. While this type of instrument is satisfactory for measuring revolutions over, say, one-minute periods, it will not measure surge speeds or momentary increase or decrease in speed which occur when load is suddenly taken off or applied. For the latter purpose, a dial instrument provided with a pointer which directly indicates speed in r.p.m. is necessary. Any deviation from the normal load speed is thus also easily noted.

Permissible changes in speed as laid down in B.S.S. 765, which covers internal-combustion engines (carburetter type) but excludes aero-engines, are 12 per cent temporary and 6 per cent permanent on suddenly taking off or throwing on the rated load. When reliable measurement of speed is difficult because of lack of access to shaft ends, a flexible drive fitted to the tachometer may help or the bearing cap on the generator, remote from the prime mover, may be taken off to give access to the shaft end. With an alternator it may be easier to ascertain the exciter speed, especially if this is on the same shaft. If it is belt-driven, the speed of the primary shaft can be calculated from the pulley sizes, but this is obviously a less satisfactory way.

Stroboscopic instruments are sometimes

resorted to where speed measurement by normal means presents difficulties; they are also useful for checking. These instruments are accurate but being of the laboratory type are not usually suitable for routine testing. The electrical tachometer, which consists essentially of a small generator working in conjunction with a moving-coil instrument graduated in r.p.m. is useful when the set is inconveniently situated, since the generator is separated from the indicator, which is consequently free from vibration and can be accurately read several feet away under favourable conditions.

The maker of the generator will require to know the speed regulation of the prime mover so that the specified compounding and regulation may be obtained under operating conditions. For example, a d.c. generator may be driven by an internal-combustion engine having a full-load speed of 1,500 r.p.m. and a no-load speed of 1,545 r.p.m. Assuming the machine to be flat compounded, in order that no-load voltage may equal the full-load voltage, the electrical manufacturer has to allow for a 3 per cent increase in engine speed.

The regulation of an alternator may be adversely affected by the power factor of the load. B.S.S. 1156 states that the inherent regulation of alternators of 50 kVA and above shall not, with constant speed and excitation, exceed 16 per cent at unity power factor and 38 per cent at 0·8 power factor. For lower outputs the equivalent figures are 14 and 28 per cent. Typical figures for a modern 125-kVA machine would be of the order of 12 per cent at unity and 30 per cent at 0·8 per cent power factors.

As defined in B.S.S. 765, the cyclic irregularity is the ratio of the maximum variation in angular velocity at the flywheel during one engine-cycle to the mean angular velocity when the engine is running at any load up to and including rated load at rated speed. It can be expressed in terms of rated speed as $\frac{\text{maximum speed} - \text{minimum speed}}{\text{mean speed}}$. For a multi-cylinder direct-coupled engine-driven generator the cyclic irregularity must not be worse than given in the foregoing table.

Engine impulses per sec.	Cyclic irregularity not worse than—
10–20	Engine impulses per second divided by 1500
Less than 10	$\frac{1}{150}$
Above 20	$\frac{1}{75}$

For engines having two cylinders or less the cyclic irregularity should not be worse than $\frac{1}{75}$.

Cyclic irregularity, as considered here, refers to the angular velocity at the rotor of the electrical machine.

Testing Procedure

The following procedure was adopted for testing a 3-phase, 50-cycle 280-kW 400/230-V alternator set with star point brought out, which was direct coupled to a four-stroke, six-cylinder 500-r.p.m. vertical compression-ignition engine. The duration of test was eight hours—six hours at full load, one hour at 10 per cent overload and one hour at fractional loadings.

The engine was provided with dial-type thermometers measuring exhaust temperatures on each cylinder and thermometers in pockets on engine water inlet and outlet and on the lubricating oil inlet and outlet. A circulating water pump and a radiator with adjustable louvres cooled both the circulating water and the engine lubricating oil. There were also a lubricating-oil cleaner, an oil-wetted air filter and a separate petrol-driven air compressor and air receiver for starting—the latter of sufficient capacity to provide for at least six starts from cold. The time taken by the compressor to charge the air receiver to a predetermined pressure was also logged.

In order to facilitate subsequent inspection of results, all engine readings were collated on the left-hand side of the test sheet and all electrical readings on the right-hand. The following readings were logged at 15-min intervals for the engine:—r.p.m., exhaust temperature on each cylinder, cooling water temperatures (in and out) and rate of flow, oil cooling temperatures (in and out) and lubricating oil pressure. From the alternator, the particulars recorded were line volts and amperes (one ammeter per phase), load in kW, power factor of load, exciter V and A and temperatures of machines and ambient air. The ambient temperature may be considerably higher at the conclusion than at the beginning of a run and is preferably obtained from at least three thermometers in different positions round the test bed.

At the conclusion of the test, in addition to machine temperatures and associated rises, the insulation resistances were ascer-

tained while the machines were hot and logged and a barometer reading was also taken.

The fuel consumption figures per kWh based on a net calorific value of 18,000 BThU per lb were 0·536 lb at 110 per cent load, 0·524 lb at 100 per cent and 0·55 lb at 75 per cent. The makers' quotations for the last two loadings were 0·55 and 0·58 lb. When full load was switched off, the speed settled down to 519 r.p.m. and the volts to 500. With load thrown off and constant speed and excitation maintained the volts rose to 462, showing an inherent regulation at unity power factor of 15·5 per cent.

Specifications often state that the fuel oil used for normal running shall be effective for starting, even when the ambient temperature is down to 32 deg F. Specifications may also require that the alternator shall generate its full kW rating over a range of, say, 400 to 425 V and that its voltage shall be variable between 390 and 425 V. The shunt field regulator must therefore be tested to see that it fulfils these conditions.

The need to check details before the start of a test was illustrated by a mishap in connection with a 50-kW Diesel set. On the day before that arranged for the test, the level of the sump oil was up to the "full" mark on the dipstick but, on checking it before starting the test run, it was found to be higher, although no oil had been added. This increase was eventually traced to the existence of a crack in the cylinder block through which water had percolated into the crankcase. A new block had to be obtained before the engine could be re-assembled for test.

Arc-Welding Generators

Single- and Multi-operator D.C. Sets

GENERATORS for d.c. arc welding are the subject of a paper by MESSRS. J. C. MACFARLANE, J. W. MACFARLANE and W. I. MACFARLANE (Macfarlane Engineering Co., Ltd.) presented to the Installations Section of the Institution of Electrical Engineers.

The authors first briefly consider the nature of the arc load as it affects the source of energy. They then tentatively suggest methods of classifying electrodes and systems of supplying current to the arcs. Comparison of generators shows that "copper" designs are required for energizing single-arc welders and "iron" designs for multiple-arc outfits.

In the case of single-operator machines load variation involves flux changes that cause sluggish response and induce e.m.f.'s in the coils under commutation. In both types of generator the m.m.f.'s of the coils under the brushes and other field-forcing methods may be utilized to enhance response to load changes.

Present design practice and standard ratings are considered to result in single-operator sets being too small and multi-operator sets too large. It is suggested that overall economy would be obtainable by making generators larger and more efficient for the former sets while employing more highly rated, fully compensated machines for the latter.

Assessment of the relative merits of the two types of outfit involves consideration of revenue, circuit disturbance and the serious effects of phase unbalance. Most d.c. arcs are now energized from single-operator generators, which tendency is correct, since their better working economy soon outweighs any initial saving that may be made by installing multi-operator plant.

But the enormous growth of industrial fabrication by welding makes the choice of multi-operator outfits tempting. What alternative is there to direct current? The authors indicate that the employment of three-phase static transformer outfits may not be so attractive as might at first appear. They suggest that the use of a.c. rotary plant as a second possibility merits more attention than it has so far received.

Their investigation shows that a twelve-operator 150 c/s single-phase rotary generator with regulators would be comparable with the equivalent static plant in respect of both capital and running costs.

Domestic Supply Surveys

A REPORT entitled "A Trial Sampling-survey of Domestic Supply Conditions," by Messrs. G. E. Barrett and W. A. Pridmore, has been issued (ref: K/T.119) by the British Electrical and Allied Industries Research Association, price 3s. 9d. post free. Its purpose is to pave the way to large-scale application of the methods dealt with, which have been partly covered by a previous report, ref.: K/T.113.

The authors recount the experience they gained while conducting a sampling survey in the Enfield (Middlesex) area of the Northmet Power Co. The statistical information they gathered is tabulated and practical advice is offered about sample selection, preparation of visits, requirements of investigators, visiting procedure and interviewing methods. The report describes the actual interrogation of selected consumers by one of the authors, who is a trained statistician, and the results are presented in a form that will enable the staffs of electricity supply undertakings to conduct similar surveys of their own.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Fluorescent Lamps

A RANGE of fluorescent lamps of both "daylight" and "warm light" colours with control gear and single or twin tube fittings is now being produced by E. K. COLE, LTD., 5, Vigo Street, Regent Street, London, W.1.

One industrial fitting for an 80-W 5-ft tube that can be supplied for chain or conduit suspension has a double parabolic reflector which is easily detachable for cleaning, two retaining keys requiring a quarter turn only; it is fitted with spring-loaded "pantograph" holders. All wiring is kept within the reflector and there is a single mains connection. The unit is constructed of mild steel sheet and it has a non-rusting finish of glazed stove enamel.

In addition a ceiling fitting is available with ballast and control gear incorporated inside the fitting itself, delivered already wired to a simple back-plate for easy installation and assembly.

The "pantograph" lampholders are available separately if required. They are patented quick-release spring loaded holders enabling lamps to be mounted in a variety of positions (such as cornice lighting, etc.) with control gear remotely situated.

Electrode Holder

Sole selling rights for the lightweight "Simpem" holder for welding electrodes, which is made by Cammell Laird & Co., Ltd., Birkenhead, Cheshire, are now possessed by the QUASI-ARC CO., LTD., Bilston, Staffs. It is designed for shipyards and site welding, accommodating electrodes up to 6 s.w.g. (250 A) and consists of two steel forgings forming "tongs" with a two-limbed gripping handle. One of the latter is a taper plug for insertion in the socket terminal of the connecting cable. Thus the holder body can be detached from the "live" connector, leaving the cable end still well insulated for use in enclosed steel structures in conformity with Home Office recommendations.

Seed Separator

British-made machines for "cleaning" wanted seed (smooth coated) by electro-magnetically abstracting weed seed (with sticky or rough surfaces) are announced under the trade name of "Purex" by the RAPID MAGNETTING MACHINE CO., LTD., Lombard Street, Birmingham, 12.

Separation is effected with the aid of a ferrous powder and wet or dry processes can be employed. The powder and water are first mixed in a motor driven drum; the fluid is then passed together with 2 cwt of seed to the mixing drum of the separator, which operates eccentric to its axis on a diagonally placed axle. The batch is discharged into a spiral conveyor feeding trays which direct the mixture into two magnetically concentrating channels, so that revolution of the drum allows smooth coated seed to fall off by gravitation. The rough coated (weed) seed, due to adherence of the iron powder, is held within the magnetic field further round the revolving drum until it is brushed off at a distance from the "cleaned" seed.

Not more than 12 lb of powder with 1·5 pints of water per 112 lb of seed are required; from 8 to 12 cwt per hour can be processed, depending on the weed content. Dry processing is similar, except that the wet mixing chamber is not needed and it is advisable to brush the seed after it has passed over the magnetic drum to restore its polished appearance. The magnetic drum is energized with D.C. and force-ventilated; the separator is driven by a 2·5 H.P. motor and the wet mixer by two ($\frac{1}{4}$ and $\frac{1}{8}$ H.P.) totally enclosed geared motors. The separator weighs 32 cwt and the wet mixer 7 cwt.

Coloured Electric Fires

Round metal fires weighing 7 lb and of 13 inches overall diameter, finished in coloured enamel, are made by BRIGHTGLOW, LTD., 320, Rayners Lane, Pinner, Middx., in 1-kW and 2-kW sizes.

Inexpensive sheet metal fires, colour enamelled with bright guard wires over the horizontal element bar, have been named "Double Anchor" by BROOKS & BOHM, LTD., 90, Victoria Street, London, S.W.1.

Coloured models are also becoming available from FALCO ELECTRICAL APPLIANCES, LTD., Coalbrookdale, Shropshire. The 2-kW size has two rod elements horizontally placed one above the other, each with its own reflector; a half-heat switch is inset below.

Garden Soil-heating Outfits

Soil warming outfits for gardeners are now in production by ELECTRO METHODS, LTD., 112, Brent Street, Hendon, London, N.W.4. They are energized from 230-250 V a.c. mains through a transformer in a weather-proof case, furnishing an output of up to 20 A at 12 V.

The heating element is 24 ft long for the 24 sq ft standard frame supplied; its loading is 120 W, representing 5 W per sq ft, so that the element will reach 132 deg F in free air at a temperature of 72 deg F. The outfit is claimed to be made in accordance with the recommendations contained in the E.R.A. report W/T 7 and larger sizes can be provided for commercial use.

COMMERCE and INDUSTRY

E.T.U. on Wages Structure. A Chief Engineer's Salary.

Folkestone Rating Appeal

ON April 13th the Recorder of Folkestone (Mr. Tristram Beresford, K.C.) gave judgment on an appeal by the Folkestone Electricity Supply Co., Ltd., against a decision of the Assessment Committee determining the cumulo rateable value of the undertaking at £8,060.

The valuation was made on the company's accounts for the year ended December 31st, 1942. The case for the company was that at the date of the proposal the value of the hereditaments was severely affected by the war, with the result that a true valuation produced a rateable value of nil. The company, however, had made an ex gratia offer to pay rates on a rateable value of £6,500, which was one-quarter of the assessment in force before the war.

The Rating Authority's valuer had supported a rateable value of £12,072 before the Assessment Committee, who called in Mr. C. Gerald Eve, P.P.S.I., to make an independent valuation. Mr. Eve advised that the rateable value should be £8,060.

The company appealed against this decision and evidence was given by the company's rating surveyor, Mr. A. R. Craig-Hall, F.S.I., and Mr. H. C. Wells, M.I.E.E., technical adviser to the County of London Electric Supply Co., Ltd. The appeal was allowed, with costs, the cumulo rateable value being fixed at the sum of £4,973.

Commercial Cooking Exhibition

Great interest was shown by local caterers in an exhibition of commercial electrical equipment held by the Great Yarmouth Electricity Department at Electric House, from April 1st to 15th. Despite shortage of supplies, and the fact that reconstruction will prevent many hotels and restaurants opening this season, actual orders were placed to the value of several thousand pounds and equivalent to a loading of some 500 kW. Inquiries regarding future installations were most encouraging and gave indication of the tremendous market for heavy-duty equipment still untapped.

Portion of an attractive commercial electric cooking display at Great Yarmouth

Radio Navigational Aids

As a preliminary to the preparation of a provisional case for the international standardization of radio navigational aids for ships, with special reference to the allocation of wavelengths, the Ministry of Transport has arranged for an informal meeting to be held in London from May 7th to 22nd. The object is to acquaint other countries with progress in England and to seek information about similar work done elsewhere. Technical representatives are expected to attend from Australia, Belgium, Canada, Denmark, Eire, Finland, France, Greece, Holland, India, Italy, Newfoundland, New Zealand, Norway, Poland, Portugal, South Africa, Spain, Sweden, United States, U.S.S.R. and Yugoslavia. Apart from a Government reception, official luncheon and other social functions, the technical proceedings will include lectures, discussions, demonstrations and visits to shore installations, ports, H.M.S. *Fleetwood*, the National Physical Laboratory and a number of manufacturers' works.

Wages in the Contracting Industry

Criticisms of the present wage structure of the electrical contracting industry appear in the April issue of the *Electrical Trades Journal*, the official organ of the Electrical Trades Union. It is contended that although certain improvements have been obtained during the war the present arrangements are obsolete. In the first place the grading of wages on a geographical basis is said to have little relevance to the present industrial and economic conditions. There is considered to be still less justification for the retention of the method of varying wages according to the official cost-of-living index, even if that index were not out of date and totally unrepresentative of the actual cost of living.

A new wage structure is advocated based upon a consolidation of existing Grade "A" and "B" rates, the up-grading of "C" to "B," consolidation of the war addition payment into base rates, and a substantial increase in the resultant "A" and "B" rates, such rates to be reviewed at six-monthly intervals by the National Joint Industrial Council for the industry. It is said that some improvement has been effected by the recent new agreement, one outstanding feature of this being the recognition by the

National Federated Electrical Association of the need for a revised wages structure.

With regard to working conditions, suggestions are made relating to travelling time and fares and country allowances; a 40-hour working week of five days is advocated, with wages based upon those for the present 47-hour week, together with a guarantee of work or payment in lieu for the 40-hour week; twelve days annual holidays plus statutory holidays are suggested instead of the present six days. The Union is in favour of the statutory registration of all operatives and contractors.

Non-Ferrous Metal Production

Speaking at the annual meeting of the International Nickel Co. of Canada in Toronto last week, the chairman and president, Mr. Robert C. Stanley, gave statistics of the company's production of non-ferrous metals during 1945. The production of nickel in all forms amounted to 251·7 million pounds; during the war the company furnished 1,500 million pounds to the United Nations. Copper output amounted to 271·7 million pounds; platinum 381,741 oz; gold 58,179 oz; silver 1·6 million oz; and selenium 168,000 lb. Accumulated stocks of nickel have necessitated a reduction of output to nearly half the wartime level. Research and development of copper markets may be expected. Canadian copper producers face difficult problems because of the United States tariff wall, the purchase by Washington of large tonnages produced in South America, and the important and adverse effect of foreign exchange, particularly in the United Kingdom and throughout the sterling area.

Birmingham Exhibitions

An exhibition was held at the Birmingham City Market Hall site from March 25th to April 6th by the Women's Land Army organizers for Warwickshire, Worcestershire and Staffordshire, in connection with the forthcoming

The Birmingham Electric Supply Department's display at a recent Women's Land Army Exhibition

Birmingham drive for recruits for the W.L.A., which is being sponsored by the Lord Mayor and Lady Mayoress. Exhibits of an electrical character as applied to farm work were displayed by the City Electric Supply Department and included automatic milking equipment, water pump, sterilizing chest, sheep shearer, incubator, hoist for sacks of grain, and other appliances.

The British Electrical Development Association's model electric home laundry and kitchen were also exhibited at Lewis's stores in a recent Housing Exhibition.

New Vactric Factory

The steel skeleton of the first section of the new Vactric factory on the Newhouse Industrial Estate, Lanarkshire, is now complete. It provides a total floor space of 240,000 sq ft. A canteen, strong rooms, filing rooms and lavatories are to be below ground. The whole of the first factory block is expected to be ready for occupation by 1947. The complete factory will comprise three blocks, totalling over 500,000 sq ft of floor space. The architects are Wylie, Shanks & Wylie. Production of the company's vacuum cleaners is being continued at the four temporary factories nearby in the meantime.

Ex-British Westinghouse Association

In present circumstances the Ex-British Westinghouse Association is unable to resume its annual dinner as had been hoped. Instead, a luncheon is being arranged at the Connaught Rooms, London, on Friday, May 17th (12.30 for 1.15 p.m.). Tickets will be 10s. 6d. each (excluding drinks and tips) and members are asked to apply for them by May 8th to Mr. L. S. Hawes, 51, Mount Ephraim Lane, Streatham, S.W.16.

Pontypridd Engineer's Salary

A decision of considerable importance has been confirmed by the National Joint Committee of Local Authorities and Chief Electrical Engineers for the Electricity Supply Industry in connection with the salary of Mr. C. N. Bancroft, chief electrical engineer to the Pontypridd Urban District Council. In 1941 the employers' side of the South Wales and Monmouthshire District Joint Committee requested the Pontypridd Council, which was then a member, to operate the 1941 National Agreement and pay its electrical engineer the appropriate salary. The Council refused and resigned from the Committee. In 1943 the Associated Municipal Electrical Engineers made a further request that the 1941 Agreement should be implemented but the Council again refused.

The A.M.E.E., under the provisions of the Conditions of Employment and National Arbitration Order, 1940, referred the matter for the consideration of the Minister of Labour as a trade dispute and as a result of the intervention of the Ministry the Pontypridd Council decided to rejoin the District Committee so as to enable the dispute to be dealt with by that Committee. The Committee after hearing the submissions of both parties in the

dispute unanimously agreed that the Pontypridd Council should implement the agreement and awarded to Mr. C. N. Bancroft the difference between the salary he had been paid and the amount that would have accrued to him under the salary schedule. This decision has been confirmed by the National Joint Committee.

Electro-medical Apparatus Beat German Bombers

How electro-medical apparatus was used to defeat a German blind bombing system was related by A.V-M. Lywood at the Batti-Wallah's Society's lunch held on Thursday last week (April 25th). After the first phase in the Battle of Britain, he said, the Air Ministry was puzzled by the fact that even in cloudy weather the Luftwaffe succeeded in obtaining a fair degree of accuracy in its bombing. After three weeks' study this success was tracked down to a development of the Lorenz blind flying system called the Knichebein or "bent-leg" system. The obvious countermeasure was jamming and as no normal apparatus was available to operate on the 4½-5 m wavelength employed the country was scoured for electro-medical apparatus which, though emitting waves of the correct frequency somewhat crudely, had the desired effect of misleading the enemy. Due to this and similar feats of improvization no blind-flying system employed by the Germans succeeded for longer than 6-8 weeks. But for this achievement British industry within 250 miles of the German occupied coast might have been knocked out.

Luton Exhibition of Portable Tools

To demonstrate the possibility of the wider use of portable tools (electric and pneumatic) in the industries of Luton and district, with particular reference to the re-housing schemes, the Luton Corporation electricity undertaking, in co-operation with certain manufacturers' associations, has this week held an exhibition at the Corn Exchange. The exhibition, which was to be opened by the Mayor of Luton on Wednesday, is on much the same lines as the one which was organized and went on tour for the Ministry of Works. In addition, however, to containing practically all the items shown in the M.O.W. exhibition there was a wide range of paint-spraying equipment.

Indian Company Formed

F. & C. Osler (India), Ltd., has been registered in India to acquire *inter alia* the assets and business previously conducted for one hundred years by F. & C. Osler, Ltd., of Birmingham and London. The company, which has been registered with a capital of Rs.1,00,00,000, will in addition to manufacturing certain electrical lines in India greatly extend the field of contract work previously covered by the English company. It will take over all the agencies held by the old company which include the Chloride Electrical Storage Co., Ltd. (batteries), Geo. Ellison, Ltd. (switchgear), W. T. Glover & Co., Ltd. (cables), Lee Howl & Co., Ltd. (pumps), Marryat & Scott, Ltd. (lifts), and the Metropolitan-Vickers Electrical Co., Ltd. (lamps). The company will undertake other agencies for electrical materials, particularly refrigeration, air conditioning and radio. Existing offices cover Calcutta, Bombay, New Delhi, and Lahore and further expansion is expected. F. & C. Osler, Ltd., 230, Broad Street, Birmingham, have been appointed home buying agents.

New Towns

The text has been issued of the New Towns Bill (Stationery Office, 9d.) which provides for the creation of new towns through the agency of Development Corporations established and financed by the Government. It is tentatively estimated that the capital cost of the development of a new town for a population of 50,000 would be of the order of £19 million, of which £15·5 million would represent expenditure by the Corporation and £3·5 million expenditure by local authorities. These figures are calculated on the assumption that such services as hospitals, gas and electricity would not be provided by the Corporation or by local authorities as such. At the present stage authority is sought for advances from the Consolidated Fund up to £50 million to enable the programme to be started. A Development Corporation will be empowered to contribute towards expenditure incurred by statutory undertakers in performance of their functions in relation to a new town, and upon the winding-up of a Development Corporation any statutory undertaking belonging to it may be transferred to statutory undertakers by order of the Minister of Town and Country Planning.

D.J.I.C. Meeting

The annual meeting of the Joint Industrial Council (South Coast Area) of the Electricity Supply Industry was held on April 15th in Winchester, where the members and delegates were accorded a civic welcome by the Mayor and Mayoress (Alderman and Mrs. Sankey). After a reception at the Abbey House, the Council paid a visit to Winchester Cathedral. Luncheon in the Guildhall followed.

E.A.W. Conference

The Rt. Hon. Emanuel Shinwell, Minister of Fuel and Power, is to be the speaker at a lunch to be held on the occasion of the twenty-first annual conference of the Electrical Association for Women next Friday. The annual general meeting will precede the lunch.

New Offices for Chesterfield

The Chesterfield Electricity Committee has approved in principle a scheme put forward by the electrical engineer, Mr. W. W. Grimes, for new offices and meter rooms and other ancillary departments.

Mechanization of China

The first step towards the execution of an ambitious plan to mechanize China has been taken by the establishment there by the Chinese National Relief and Rehabilitation Administration (CNRRA) of a machine assembly plant and training school for Chinese mechanics. Students at the school will learn as they assemble and condition the thousands of tons of machinery which are arriving in the country. The school is staffed by 150 technical personnel, including mechanical and electrical engineers, tool-makers,

Diesel fitters and motor mechanics. Eighty per cent of them are Chinese. Similar assembly plant schools are also to be opened in Canton and Tientsin, with branch workshops in the provinces of Kiangsi, Hunan, Hupeh, Anhwei and Kiangsu.

Marconi Exhibition

For the benefit of delegates to the international conference on radio aids to marine navigation, the Marconi International Marine Communication Co., Ltd., is to hold an exhibition at the London Exhibition Centre, Leicester Square, W.C.2, from May 10th to 24th inclusive. The display will include a complete range of Marconi post-war marine equipment, including marine radar equipment MN1, as well as representative products of the company's subsidiary, Marconi Instruments, Ltd. Admission is by ticket obtainable only from Marconi House, Chelmsford.

Barrow Dispute

Barrow-in-Furness Electricity Committee is to fight the ruling of the Electricity Commissioners over the payment of compensation to the owner of a wireless set rendered useless by the change-over from D.C. to A.C. When the Committee repudiated responsibility some time ago, Mr. John Robertson, of Ferry Road, Barrow, appealed to the Electricity Commissioners, who decided that "secret" instructions drawn up by the Town Council in 1938 for dealing with the replacement of apparatus affected by such a change-over, were contrary to law and could not be enforced. The Committee has rejected a proposal that Mr. Robertson's claim should be met, and has reaffirmed its intention to stand by the original instructions.

Trade Publications

Murex, Ltd., Rainham, Essex.—Two booklets respectively naming metallurgical and chemical products used by the electrical, radio, welding and other industries and giving standard specifications with typical analyses of metals, alloys, powders and metallic carbides.

C. J. Fitzpatrick & Co., Ltd., Stonebridge Park Works, North Circular Road, London, N.W.10.—Illustrated folder describing geared motors of 0·25 to 2 H.P. with seventeen output speeds from 25 to 345 r.p.m., double or triple reduction.

Gresham Transformers, Ltd., Twickenham Road, Hanworth, Middlesex.—Illustrated folder technically describing transformer-type voltage stabilizers of 50 to 500 VA air cooled, or 1,000 to 2,000 VA oil cooled.

Readers applying for copies of these publications should write on their firms' notepaper.

Dutch Visitors at Reyrolle's Works

With a view to fostering closer Anglo-Dutch relationship, a delegation of Dutch sportsmen headed by Burgomeister van der Linden, of Groningen, has been on a short visit to Newcastle-on-Tyne and district. Dr. M. J. M. Dirken, engineer of the Dutch short-circuit testing station, K.E.M.A., was also in the party and on April 26, together with the Lord Mayor of Newcastle, they inspected the works of A. Reyrolle & Co., Ltd., Hebburn-on-Tyne. In welcoming the visitors Col. B. H. Leeson, managing director, made reference to the already existing strong tie linking Tyneside with Hengelo, Holland, through the more than 20-year-old intertrading association established between Reyrolles and N. V. Hazemeyer.

Surplus Machine Tools

The Ministry of Supply has opened a Machine Tool Regional Disposal Centre at G.E.C. Building, Kingsway, Cardiff.

Trade Announcements

On May 6th the General Accessories Co., Ltd., is transferring its sales offices at Bristol and Leatherhead to a central organization in London, which will be under the supervision of Mr. F. C. Fuke, a director of the company. Future orders and inquiries for "Clix" and "Genacco" electrical accessories should be addressed to 21, Bruton Street, London, W.1 (telephone: Mayfair 5543; telegrams: Tegenacco, Wesdo, London).

W. A. Sparrow & Co., Ltd., state that their sole address in the City of London is now 65, London Wall, E.C.2.

With reference to the announcement last week that Tube Investments, Ltd., had acquired the business of A. P. Lundberg & Sons, Ltd., we are informed that the products of the latter company will in future be produced and marketed in co-operation with the Simplex Electric Co., Ltd.

The telephone number of Mr. R. B. Whittick of Abford House, Wilton Road, S.W.1, has been changed to Victoria 5957-8 Mr. Whittick has formed Engineering Sales & Export, Ltd., to cater for the electrical products which he handles.

The Eastbourne branch of Walsall Conduits, Ltd., has moved to larger and more central premises at 96, Seaside Road, Eastbourne (telephone: 3396).

TRADE MARKS

THE following applications have been made for the registration of trade marks. Objections may be entered within a month from April 24th:—

THE WARDEN. No. B637,058, Class 9. Apparatus for controlling the application of electric current to wire fences.—Harvest Saver & Implement Co., Ltd., 65, South Molton Street, London, W.1.

AUTOLEC. No. 638,695, Class 9. Electric control apparatus for domestic power and lighting circuits and appliances; electrical switchgear and distribution boards; electric distribution systems for buildings.—G.W.B. Electric Furnaces, Ltd., Elecfurn Works, Watford By-Pass, Watford.

DELICOLOR. No. 636,781, Class 11. Lighting installations and apparatus and parts thereof not included in other classes.—W. J. Furse & Co., Ltd., Traffic Street, Nottingham.

REMAX. No. 639,187, Class 14. Electric clocks.—Remax, Ltd., Remax House, Alfred Place, London, W.C.1.

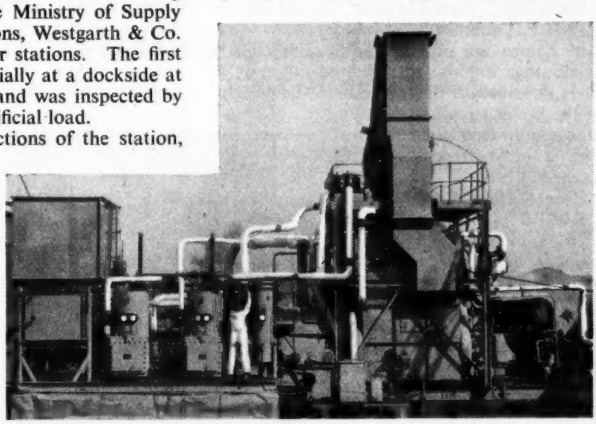
ELECTROVIS and KABLOVIS. Nos. 638,887 and 638,888 respectively, Class 17. Electric insulating compositions.—Astor Boisselier & Lawrence, Ltd., 69 & 70, Mark Lane, London, E.C.3.

Transportable Power Plant

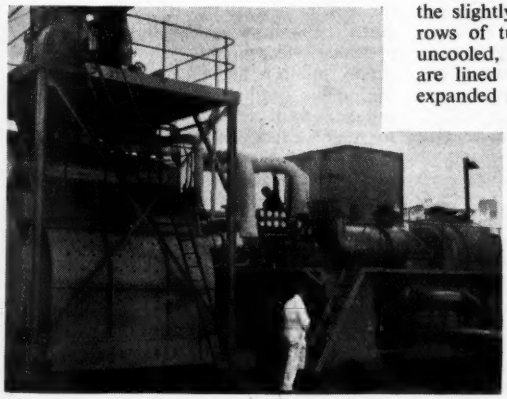
Complete Stations in Four Sections

FOR the purpose of affording supplies of electricity quickly in any part of the world where any kind of condensing water is obtainable, the Ministry of Supply ordered from Richardsons, Westgarth & Co. five transportable power stations. The first of these was tested officially at a dockside at Hartlepool last month and was inspected by us when running on artificial load.

Three of the four sections of the station, viz., boiler plant; turbo-alternator and condenser; evaporator, feed pumps and feed tanks were manufactured by Richardsons, Westgarth themselves, which is claimed to be a unique performance. The fourth section comprising the switchgear was provided by the British Thomson-Houston Co. Each section is mounted on a fabricated steel base plate which can be skidded into position.



From this side of the combined units the evaporating plant and water-tube boiler can be seen



The other side of the water-tube boiler showing the turbine and alternator

Steam at 370 lb per sq in. and 675 deg F is supplied by a two-drum steel-cased Foster-Wheeler boiler oil-fired by means of Wallsend-Howden equipment complete with hand lighting unit and having a maximum continuous rating of 33,000 lb per hr and a designed overall efficiency of 80 per cent. Its combustion chamber is on one side of the slightly inclined main bank of eighteen rows of tubes. Front and rear walls are uncooled, but the outer wall with the roof are lined with forty-five tubes, which are expanded on the top into the steam drum, 3 ft. internal diameter by 10 ft. long, and at the bottom into a heater fed from the water drum by forty-five heat-insulated and tiled tubes that form the floor, giving a heating surface of 2,580 sq ft.

Behind the front row of tubes is the superheater composed of seventy-six U bends providing an additional heating surface of 443 sq ft. In addition to this the Foster economizers (E. Green & Co.) with shrunk-on cast-iron gills with eighteen U-bends gives a further 783 sq ft. Mountings include an automatic feed-water regulator, low-water alarm and hand-operated soot

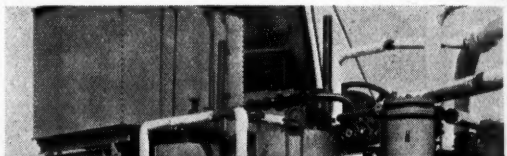
blowers. Phosphate and sodium-sulphite caustic-soda treatment of raw water is given by Kennicott plant.

A Howden-Turbovane induced-draught turbine-driven fan is placed on the top of the boiler structure at the base of the short chimney. Mounted with the oil-fuel unit at firing-floor level is a Howden double-inlet "Silentvane" forced-draught fan driven by a 13-H.P. Laurence Scott motor. Two Weir feed pumps are provided, one driven by a single-stage impulse turbine, the other by a 57-H.P. Laurence Scott motor. The weight of the boiler structure including fans and oil feed unit is 45 tons. The water softener weighs a further 1½ tons.

The 2,500-kW 3,000-RPM "RW-BB" turbo-alternator with condensing plant weighs 40 tons and can be mounted with (as on a barge) an angle of deviation from the horizontal longitudinally of one in twelve and transversely of one in six. The turbine has a two-row impulse wheel followed by forty-one rows of reaction blading. Rotor blades and high-pressure cylinder blades are of stainless iron; low-pressure cylinder blading is of brass. The steam admission valves control groups of nozzles for half, two-thirds and full-load. A steam-driven automatic oil pump is installed for starting and shutting down. Lubricating oil is treated by a Serck cooler and an Alfa-Laval purifier. The totally enclosed 50-cycle alternator, wound for 6,600 V, is fan ventilated with air passed through a Heenan & Froude tubular cooler. Its field is provided by a 23-kW, 110-V, shunt-wound exciter. Thermocouples embedded in the stator windings and core are led to a Cambridge multipoint thermometer on the switch cubicle.

With its 2,000 sq ft. of surface the twin-shell condenser is designed for a vacuum of 26·8 in. Hg. with 2,400 gal per min of cooling water at 68 deg F. The 85-H.P. circulating-water pump and 10-H.P. priming pump can be placed near the water source and connected to the condenser by "Everite" pipes. Other auxiliary equipment comprises a two-stage jet-operated air ejector, a 5·5-H.P. horizontal centrifugal extraction pump and a Richardsons, Westgarth automatic closed-feed control valve. These pumps are by W. H. Allen, Sons & Co. and their 400-V weatherproof squirrel-cage driving motors are of B.T.H. make and have a starting torque of 50 per cent of full load.

Condensate is discharged through the inter-condenser incorporated with the air ejector and then led to a 2,000-gal hotwell, which is mounted over an 800-gal raw-water tank. On the suction side of the feed pumps is a six-pass surface heater for producing a feed temperature of 160 to 200 deg F. An important part of the plant is that for providing distilled water from local sources for boiler feed. Two Richardsons, Westgarth evaporators are fitted together with a preheater, feed pump and transportable supply pump. The plant can be operated for double distillation to produce make-up water up to 5 per cent of boiler capacity or for double effect (with good water) to provide 9 per cent. Single-effect operation can be resorted to with better quality water or when double the amount of normal make-up is required in emergency.



Evaporating plant

The main feature of the transportable power station was that it should be capable of being transported and erected at any site, and that it should be designed for maximum reliability and ease of operation. The question of high efficiency and a low fuel consumption per kilowatt hour produced was therefore not regarded as of major importance when the designs were prepared. The following results were obtained at official tests which took place in April.

At full load the turbine stop valve pressure was 349 lb per sq in. and the temperature

657 deg F (vacuum 28·87 in. gauge). The alternator output was 2,408 kW and the steam rate 10·83 lb per kWh, corrected to 11·43 lb. Fuel consumption, including all auxiliaries and evaporators (in single effect) was 1·053 lb per kWh (corrected to 1·109 lb) against the design figure of 1·19 lb, showing an improvement in fuel rate of 6·7 per cent; calorific value of fuel 18,500 BThU per lb.

The half load figures were:—Alternator output 1,206 kW; steam rate 10·85 lb per kWh (corrected to 11·44 lb); fuel consumption, with evaporators in double effect, 1·053 lb per kWh (corrected to 1·111 lb); against the design rate of 1·24 lb; improvement in fuel rate 10 per cent.

ELECTRICITY SUPPLY

Ring-Main Wiring at Billingham. Exeter Voltage-Change Cost.

Billingham-on-Tees.—DOMESTIC RING MAINS.—Following an interview with representatives of the North-Eastern Electric Supply Co., Ltd., the Urban District Council is to adopt the ring main system of wiring its houses, each of which will have an electric wash boiler and an immersion heater fitted in the hot water cylinder. The company is to hire electric cookers at 2d a week and kettles and irons at 1d a week.

Birkenhead.—BROMBOROUGH POWER STATION.—The Electricity Committee recommends that Mr. B. E. Roberts, of Sir Alexander Gibb & Partners, shall be appointed resident engineer for the preliminary work in connection with the new power station at Bromborough and that the tender of Sir Alfred McAlpine & Son,Ltd. of £57,570 be accepted.

SUBSTATIONS.—The Electricity Department proposes to erect and equip a number of new sub-stations estimated to cost £37,185.

Brighton.—CHANGE-OVER.—It is proposed to change over the supply to some 450 consumers in the Harrington Road area from D.C. to A.C., and a new substation and distributors are to be provided at a cost of £4,024.

Ealing. — MAINTENANCE OF DOMESTIC APPARATUS.—Having been informed by the Housing Committee that the Uxbridge & District Electric Supply Co., Ltd., cannot undertake to service electrical apparatus in Council houses, the Electricity Committee has agreed to carry out the work in houses outside its area of supply on the understanding that the cost will be met from the housing accounts.

Exeter.—COST OF VOLTAGE CHANGE.—The city electrical engineer recently reported to the Electricity Committee that the cost of changing from the present 210-V system in Exeter to the proposed 240-V standard would be approximately £200,000. It appeared that even if the cost were met by a national levy in the industry the undertaking would still be faced with an expenditure of approximately £25,000 plus the annual cost of the levy over a period of years. In 1927 the entire cost of changing from 105 to 210 V, amounting to approximately £21,000, had to be paid for by the undertaking out of revenue.

INCREASE IN CITY RATES.—The Electricity Committee reports that the increase in the general rate from 10s 6d to 15s in the £ will mean an additional cost of about £6,000 to the undertaking.

Fulham.—STANDARDIZATION OF DISTRIBUTION SYSTEM.—In February the Council authorized an expenditure of £50,000 on the standardization and reinforcement of the main distribution system on the low-voltage side, making it three-phase 415/215 V. On the advice of the borough electrical engineer it is now proposed to change the high-voltage system from 6,600 to 11,000 V at an estimated cost of £157,280.

POWER STATION EXTENSION COSTS.—The Electricity Committee reports that when the estimates for the power station extensions were prepared it was difficult to estimate the cost of the civil engineering and superstructure work. A sum of £83,600 was provided, but it is now anticipated that the cost will amount to £125,000 and that in addition £5,000 will be necessary for meeting the requirements of the Ministry of Works. A sum of £8,000 was estimated for tiling and decorative work, but it is now proposed to make provision for faience and terrazzo tiling and the additional cost will amount to £33,400.

Gillingham. — ANNUAL ACCOUNTS. — The 1944-45 accounts of the Electricity Department (borough electrical engineer, Mr. H. Hall) show a total revenue of £126,137 (against £116,557 in 1943-44) and a net profit of £4,292 (£1,789). Sales amounted to 21·2 million kWh compared with 18·9 million kWh in the previous year.

Haltemprice.—CONVERSION OF LIGHTING.—The Urban District Council has asked the Hull Corporation Electricity Department to install electric street lighting in the Hessle and Anlaby areas in place of the existing gas lighting. About 650 lamps are involved.

Hull.—RISING DEMAND.—In his monthly report to the Electricity Committee the general manager (Mr. D. Bellamy) said that the power station output at the present time was equal to that at the heaviest period of the year. So far the undertaking had connected 1,002 prefabricated houses, each of which had thermostatically controlled water heating and 649 had electric cookers and wash-boilers. He referred to the decision of the Housing Committee to make four out of every five future houses " all electric."

Islington.—WATER HEATERS AND FIRES.—The Borough Council Housing Committee has approved a proposal for the installation in the Canonbury and Essex Road housing estates of electric water heaters and inset electric fires in all bedrooms other than the first. Electric cookers and kettles are also to be supplied direct to the tenants on hire terms.

Keighley.—DISPOSAL OF GENERATING PLANT.—Reviewing the position of the trading under-

takings in his "budget" speech, Councillor H. Wright, chairman of the Finance Committee, said that in future the Electricity Department would be developed as a distribution undertaking. The generating plant would no longer be required and would be disposed of. The debt on the plant was small. War conditions had operated against the Department and in 1944-45 there was a loss of £4,620. For 1945-46 there would probably be a loss of £900 and for the current year it was estimated that there would be a profit of £2,600.

Kingston-upon-Thames.—NEW GENERATING STATION.—The laying of the foundation stone of the new generating station in Down Hall Road is to take place on May 15th.

Lancaster.—RURAL DEVELOPMENT SCHEME.—More than 50 per cent of the residents of Cockerham and Thurnham have indicated that they wish to be included in the Corporation's scheme of rural electrification. The Corporation offers to provide mains and services free of charge subject to houses, farms and farm buildings being fully wired and equipped to its specifications during the work of installation. Consumers in private houses, farmhouses and farm buildings will be able to obtain electricity on the basis of 25 per cent of the net rateable value and 1½d. per kWh.

Loughborough. — ANNUAL REPORT. — The 1944-45 report of the borough electrical engineer and manager (Mr. J. P. Tucker) shows that 26·8 million kWh was sold at an average price of 1·12d. compared with 27·2 million at 0·995d. in the previous year. Total receipts amounted to £136,418 (£127,047), and there was a net profit for the year of £134 (£194).

North Wales.—DEVELOPMENT SCHEME.—Replying to a question at the quarterly meeting of the North Wales and South Cheshire Joint Electricity Authority the chairman (Alderman Arthur Hewitt) said that preliminary discussions had taken place regarding the proposed £15,000,000 hydro-electric development scheme, but it was premature to give details.

Col. Rankin, director and general manager of the North Wales Power Co., alluded to recent ill-informed criticisms levelled against the company. He said that in spite of almost insuperable difficulties in the way of development the company's expenditure on new construction amounted to over £583,000 during the war years. Since the end of the war 190 schemes had been authorized to a value of £267,000, and 79 had actually been carried out. Schemes under consideration would involve a further expenditure of at least £281,000. Mr. A. E. Stabler considered Col. Rankin's complaint fully justified and expressed the view that more publicity should be given to the work of electricity undertakings and the J.E.A.

Northumberland.—SCHOOL HEATING.—The County Education Committee has decided that electric heating should be provided wherever possible in temporary buildings erected to increase the school accommodation. Originally it was proposed to use open fires.

Poplar.—NEW POWER STATION.—The Borough Council Electricity Committee has submitted to the London County Council further drawings of the new power station which revise the architectural treatment as regards mass, silhouette and composition. The Central Electricity Board has sanctioned the purchase of the site from the Port of London Authority at a total cost of £227,550.

Rotherham.—SUPPLIES TO HOUSES.—The Electricity Committee is seeking sanction to supply 120 houses on the Monkswood estate (cost, £3,800) and 178 houses on the Highfield estate, Swinton (£4,500).

Southampton Jubilee

THE Minister of Fuel and Power (Mr. E. Shinwell) was the principal guest at a luncheon held last Saturday at the Polygon Hotel, Southampton, following the opening of an exhibition commemorating the jubilee of the Corporation Electricity Department. Responding to the toast of the undertaking proposed by the Minister, the chairman of the Electricity Committee (Alderman G. Bennett Bascomb) said that the exhibition was also intended to serve as the start of an electrical publicity campaign. He outlined the Department's development plans, including the erection of central showrooms to replace premises destroyed during the air raids on the town.

The history of the undertaking is reviewed in a handsome illustrated brochure prepared and written by Mr. W. G. Turner, who has been borough electrical engineer for more than twenty-five years. The Corporation purchased the undertaking in 1896 for £21,000 from the Southampton Electric Light & Power Co., Ltd., which had provided a supply for seven years and had erected a central station, called Back-of-the-Walls, in the old part of the town.

Mr. E. Manville (later Sir Edward Manville) was engaged as consulting engineer in connection with the purchase and Mr. J. H. Lee, who was the resident engineer for the company, continued in that capacity under the Corporation. In 1898 Mr. F. H. Chaplin was appointed as borough electrical engineer, his successors in later years being Mr. H. F. Street (1902-1919) and Mr. H. S. Ellis (1919-1920). In 1903 the foundation stone was laid of the present Western Esplanade generating station, which was built on a site of four acres of mudlands at the estuary of the River Test. Since that time the site has been enlarged, the present area being about eleven acres. The total plant capacity of six sets is now 88,000 kW, ten times the original figure, and the total evaporative capacity of the boilers is 821,100 lb per hour.

The present area of supply is 44 sq miles with a population of 219,900. The number of consumers had reached 59,349 before the war. A large part of the town was destroyed by enemy air attacks, but the undertaking is recovering from the effects and the number of consumers is now 55,431.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The English Electric Co., Ltd., is to purchase the whole interest of Cable & Wireless (Holding), Ltd., in Marconi's Wireless Telegraph Co., Ltd., other than the latter's holding in the share capital of Cable & Wireless, Ltd. Negotiations for the deal have been going on for about two years and it is not in any way connected with the nationalization plan for Cable & Wireless, Ltd. The sale is subject to the approval of the Treasury and the Capital Issues Committee, as well as the shareholders of the two companies concerned. The English Electric Co., Ltd., states that hitherto it has remained outside the radio field, but it is natural, in view of the increase in the scope of the industry, which is now more broadly regarded as "electronics," that the company should wish to extend its interests in this sphere.

The Hoffmann Manufacturing Co., Ltd., reports a loss for 1945 of £32,092 compared with a profit of £77,606 for the preceding year. A sum of £100,000 is transferred from tax reserve and the ordinary dividend is maintained at 7½ per cent tax free, leaving £119,922 (£114,004) to be carried forward. It is stated that the reorganization of the Chelmsford factory is proceeding satisfactorily and the order book position is good, but the report adds that improvement in results for the current year can only be achieved by reduction in costs, by new methods and the installation of labour-saving devices.

Sangamo Weston, Ltd.—Consequent upon the cancellation of Government contracts there was a sharp reduction in turnover last year and the trading profit fell from £86,636 in 1944 to £23,422. After allowing £926 (against £31,944) for tax the net profit was £2,493 (£28,379). The dividend is maintained at 15 per cent, the carry-forward being lowered from £153,403 to £142,902. The report states that the company has a full order book but results for 1946 will largely depend on the supply of labour and materials.

The North Somerset Electric Supply Co., Ltd., in its accounts for 1945, shows a revenue balance of £55,595 (against £62,880 for 1944), to which is added £1,870 (£1,380) interest and dividends, and £6,875 (nil) transferred from war insurance and other contingencies account. Income tax, including provision for future taxation on profits to date, amounts to £23,716 (£49,400) and £5,000 (same) is transferred to general reserve; last year £4,000 was also transferred to war insurance, etc., account. Besides maintaining the dividend on the ordinary stock at 7 per cent it is proposed to pay a bonus of 2½ per cent, and the carry-forward is raised from £6,434 to £10,433. The consolidated accounts of the company and its subsidiaries show a revenue balance of £59,051 (£65,902).

In a circulated statement the chairman (Mr. F. Christy) says that already in 1946 the downward trend in supplies (from 93·6 million kWh in 1944 to 90·9 million last year) has been arrested, due to the growth of the domestic load and the connection of new industrial supplies. In spite of the rise in costs since 1939—coal by 125 per cent and local rates by 36 per cent—no alteration has been made in tariffs. Commenting on the Government's nationalization proposals, he says that attention is being diverted from vital and urgent problems and a spirit of frustration and unsettlement is being engendered which is bound to have an adverse effect on recovery.

The Woking Electric Supply Co., Ltd., reports a revenue balance of £94,991 (compared with £104,942 for 1944), plus £3,339 (£3,139) interest. Income tax absorbs £30,782 (£27,276). A sum of £26,564 (£22,191) is allocated to depreciation and renewals fund, and £10,000 (£20,000) to reserve; last year £5,000 was also set aside for war contribution reserve. As already announced, the ordinary dividend is maintained at 7½ per cent tax free for the year, leaving £5,122 (£6,158) to be carried forward. A total of 45·6 million kWh was sold in 1945 compared with 48·1 million kWh in the previous year.

London Electric Transport Finance Corporation, Ltd.—The accounts for 1945 show loans to transport undertakings amounting to £36,976,290, compared with the figure of £36,975,658 given in the previous year's accounts. Under the agreement of 1935 sums not exceeding £40,000,000 may be borrowed.

The Pressed Steel Co., Ltd., with a final dividend of 17½ per cent, has maintained the year's distribution at 27½ per cent. The net profit was £172,515 (£195,005).

Burma Electric Supply Co., Ltd.—The accounts for the year to July 31st last show a surplus of £3,105 (against £122), and £4,732 (£1,627) is carried forward. Referring to the properties in Mandalay, it is stated that destruction is complete and there appears to be no part of the plant capable of repair or for use in re-equipping the power station. A claim for compensation for damage during military occupation has been submitted to the Government.

The Radio and Television Trust, Ltd. (formerly Philco Radio & Television Corporation) has deferred consideration of dividend on the 6 per cent preference shares and interest on the 6 per cent sinking fund certificates for the past half-year pending final settlement of wartime contracts.

The Sturtevant Engineering Co., Ltd., from a net profit of £35,605 (against £25,074) is paying a final dividend of 9¾ per cent, free of tax (against 6½ per cent), making 14¾ per cent (against 11¼ per cent) tax free.

Pinchin, Johnson & Co., Ltd., report a net profit, before meeting taxation, of £552,380 (against £526,661). The ordinary dividend is raised from 10 to 15 per cent.

The Calcutta Electric Supply Corporation, Ltd., is maintaining the year's dividend at 6 per cent, tax free, by a final payment of 3 per cent, tax free.

The West Devon Electric Supply Co., Ltd., has declared a dividend of 5 per cent, as last year, plus a bonus of 2½ per cent.

Broom & Wade, Ltd., announce the payment of an interim dividend of 7½ per cent. Last year the interim was 11¼ per cent to equalize the distribution between old and new shares.

New Companies

Philament Electric, Ltd.—Private company. Registered April 11th. Capital, £5,000. Objects: To carry on the business of manufacturers of, and dealers in, electrical fittings and accessories, etc. A. W. Phillips, 9, Gernant, Rhiwbina, Cardiff, is the first director. Registered office: 27, Park Place, Cardiff.

Calectric, Ltd.—Private company. Registered in Edinburgh March 29th. Capital, £1,000. Objects: To carry on the business of electrical and mechanical engineers, suppliers of electricity, etc. Directors: J. MacRae, 3, Huntly Place, Inverness, and I. D. MacDonald, 17, Queensgate, Inverness. Registered office: Shiplands, Inverness.

Electrical Wholesalers (Midlands), Ltd.—Private company. Registered April 2nd. Capital, £2,000. Objects: To carry on the business of electrical, lighting, heating, refrigerating, wireless, engineers, etc. Directors: F. C. Payne (permanent director and chairman), 4, Slater Street, Great Bridge, Tipton, and two others. Registered office: 149, Horseley Heath, Tipton, Staffs.

Ibrox Electrics, Ltd.—Private company. Registered in Edinburgh April 2nd. Capital, £500. Objects: To carry on the business of manufacturers, exporters, importers and repairers of, and dealers in, dynamos, motors, armatures, etc. Directors: S. Black, 25, Harley Street, Glasgow, S.W.1., and W. Holmes, 8, Bankfoot Road, Glasgow, S.W.2. Registered office: 54, Ibrox Street, Glasgow, S.W.1.

R. Finlayson & Co. (Caithness), Ltd.—Private company. Registered in Edinburgh April 2nd. Capital, £2,000. Objects: To carry on the business of electricians, electrical engineers, etc. Directors: R. Finlayson, Breadalbane House, Wick, and two others. Registered office: 11, Lower Dunbar Street, Wick, Caithness.

International Electrical Industries (N.I.), Ltd.—Private company. Registered in Belfast March 28th. Capital, £5,000. Objects: To carry on the business of electricians, electrical engineers and contractors, etc. Subscribers: F. W. Zebedee, 29, Cabinhill Gardens, Belfast, and L. H. Taylor, 255, Belmont Road, Belfast.

Alvarez Electrical Products, Ltd.—Private company. Registered April 10th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, electrical apparatus and equipment, etc. Directors: E. D. Alvarez and Jane R. Alvarez, both of 150, Lewis Flats, Amhurst Road, E.8. Registered office: 48, Ball's Pond Road, Dalston, N.1.

F. Kilburn & Son, Ltd.—Private company. Registered March 28th. Capital, £1,000. Objects: To acquire the business of electrical engineers carried on by F. Kilburn & Son at 26, Huntsworth Mews, Dorset Square, N.W.1. Directors: F. C. Kilburn, 64, Ivor Court, Gloucester Place, N.W.1; and W. F. Crook, 47, Fleetwood Road, Dollis Hill, N.W.10. Registered office: 26, Huntsworth Mews, N.W.1.

Domestic Electrical Supplies, Ltd.—Private company. Registered April 2nd. Capital, £1,000. Objects: To carry on the business as indicated by the title. Directors: F. G. Bryant, 38, St. George's Drive, Carpenters Park, Watford, and two others. Registered office: 187, Marlows, Hemel Hempstead.

Percy England, Ltd.—Private company. Registered April 2nd. Capital, £3,000. Objects: To acquire the business of electrical and radio engineers carried on by P. England and W. J. Miller, at 420, Waterloo Road, Blackpool. Directors: P. England, 420, Waterloo Road, Blackpool, and W. J. Miller, 24, Penrose Avenue, Blackpool. Registered office: 420, Waterloo Road, Blackpool.

Alfa Electric Co., Ltd.—Private company. Registered April 10th. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, electrical apparatus and equipment, etc. Subscribers: S. Conway and P. Fisher, both of 63a, Great Russell Street, W.C.1. Registered office: 63a, Great Russell Street, W.C.1.

McEnroe Products, Ltd.—Private company. Registered April 9th. Capital, £5,000. Objects: To carry on the business of manufacturers of, and dealers in, electric stoves, refrigerators and appliances, etc. Directors: H. Beecroft, East wood, Larkfield Drive, Rawdon, near Leeds, and F. E. Hodgson, 3, Southlands, Horsforth, near Leeds. Registered office: 4, Wormald Road, Leeds, 2.

A. B. Thompson (Ireland), Ltd.—Private company. Registered in Belfast March 30th. Capital, £1,000. Objects: To carry on the business of agents for the supply of electrical equipment of all kinds, etc. Directors: A. B. Thompson and Mrs. Ida B. Thompson, both of Piney Ridge, Malone Road, Belfast. Registered office: 9, Donegall Square South, Belfast.

Intercommunication Equipment Co., Ltd.—Private company. Registered April 6th. Capital, £1,000. Objects: To carry on the business of electrical engineers, etc. Directors: H. Lewis, 8, de Montford Road, S.W.16, and three others. Registered office: 14-18, Queen Victoria Street, E.C.4.

P. H. Boys & Co., Ltd.—Private company. Registered March 26th. Capital, £1,000. Objects: To carry on the business of electrical equipment specialists, etc. Directors: G. J. Irons, 72, Warren Road, Banstead, and two others. Registered office: 187, Goswell Road, E.C.1.

Carling & Wright (Leeds), Ltd.—Private company. Registered April 17th. Capital, £1,000. Objects: To carry on the business of electrical, radio and television engineers and contractors, etc. Directors: C. Carling, 1, Cheltenham Mount, Harrogate, and J. W. Wright, 2, Imperial Terrace, Armley, Leeds. Registered office: 22, Park Lane, Leeds.

Haven Electrical, Ltd.—Private company. Registered April 15th. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, electrical and mechanical equipment and apparatus, etc. Directors: R. J. Williams, 4, Wells Road, Ilkley, and T. Handley, 6, Valley Gardens, Leeds. Registered office: 34, Central Chambers, Ealing, W.5.

STOCKS AND SHARES

STOCK EXCHANGE markets continue very active. There is a hoary tradition in the House to the effect that members are either too fully employed for them to spare time to eat, or, on the other hand, are so slack that they have no money with which to buy food. At the moment, the position leans to the former alternative. A wave of wild speculation in South African shares is accompanied by a heavy volume of business on behalf of people who, with money to invest, view with apprehension the Government's persistent policy of ever-cheapening interest rates. One feature this week has been a brisk rise in the price of Cable & Wireless, on publication of the Bill and White Paper relating to the nationalization of the company. Another feature is a substantial advance in Vactric shares, due, it is commonly reported, to buying on behalf of American interests. In the manufacturing and equipment market, the demand for good shares is as keen as ever.

Cable & Wireless

Speculative interest in Cable & Wireless (Holding) stocks was reawakened by the appearance of the White Paper and, text of the Bill on the acquisition of the operating company by the State. So far as compensation details are concerned, the White Paper adds little to those already known. Government stock is to be issued as compensation, but the scale will depend on the result of negotiations in progress between the company and the Treasury. Failing agreement between the two parties, a tribunal of three will be set up to decide the price to be paid. Prices of the stocks concerned have tended to sag since the subsidence of the market activity previously aroused by the first Government announcement on the subject last November. Last week's revival of interest took an optimistic turn, producing appreciation of 8½ points in the price of the ordinary, at 104, and of 2 points, to 114, in the preference stock. There is still no news of the Holding Company's intended future after the Government has taken over the subsidiaries.

English Electric

A very interesting development which has nothing to do with the nationalization decision has been announced, in the sale of Cable & Wireless (Holding) interests in Marconi's Wireless Telegraph Company to the English Electric Company. The proposed deal is subject to various approvals. The Treasury, the companies' shareholders and the Capital Issues Committee, have all to give their consent before the transaction can be completed. If it goes through, a settlement will be made in cash, and it will give the English Electric a fresh branch in the electrical engineering world. The Marconi Company is mainly connected with the lighter side of wireless engineering, while the English Electric so far has been more particularly concerned with the heavy side. English Electric shares have risen 11s., to 66s., on the month.

Radio Shares and E.P.T.

A spurt last week in the price of E. K. Cole 5s. shares to 35s. is attributed in part to a belated recognition of the benefits to be expected from E.P.T. relief. For 1945, the tax provisions were equal to almost exactly half the year's profit. Electrical & Musical Industries are 3s. 3d. up at 34s. 9d. This company's consolidated profits statement published six months ago showed taxation at over £1 million against the profit of £1,346,000. A. C. Cossor's financial year ended in March. Last year the final dividend and report appeared in July. The price is 1s. 9d. down, on the month, at 39s. 6d. Decca Records at 60s. have lost 1s. 3d. Radio & Television are a few pence harder at 10s. 9d.

Fluctuations of the Month

Considerable rises have occurred during the past month in the prices of stock and shares dealt with here. British Electric Traction deferred is 70 points up, at 1145. Electric Construction ordinary shares at 65s. are 5s. better, General Electrics 7s. 3d. up at 5 1/16, Lancashire Dynamo 10s., at £6, De la Rue 12s. 6d. at 11¼. Many other advances are shown in this week's price-lists. Home electricity supply ordinary shares have mostly moved in the contrary direction; the falls are of 6d. or 1s. each. Exceptionally, Clyde Valley at 37s., and Scottish Power at 36s., are down by a florin and 1s. 6d. respectively. In the Overseas group, Tokyo sixes are 3 points to the good at 37½, Perak Hydro-Electrics have gained 2s. 6d. at 17s. Central Electricity issues are better. London Electric Transport 2½ per cents at 101 rose 1¼. Transport " C " stock at 60 is 3 points higher, and Southern Railway issues are better on the month.

Dividend Announcements

The unevenness of the 1945 results published during the last few weeks by some of the leading telephone apparatus companies, suggests that the problems of the transitional period have varied a good deal, even within individual industries. Preliminary figures announced by H.T.A., formerly known as Hall Telephone Accessories, show that a trading loss of £60,000 has been converted by E.P.T. recoveries into a surplus of £105,000. The dividend is again brought up to 10 per cent, but shareholders do not this time receive the 2½ per cent cash bonus paid for the last four years. Last September, when the interim was due, the company announced that dividend decisions would be postponed until after consideration of the accounts, in view of the changes in the manu-

(*Continued on page* 709)

ELECTRICAL INVESTMENTS

Past Month's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price Apl. 26	Month's Rise or Fall	Yield p.c. £ s. d.
Home Electricity Ordinary					
Bournemouth and Poole	12½	12½	61/6	+6d.	4 1 2
British Power and Light	7	8	31/6	−6d.	5 1 7
City of London	6	7	29/–	..	4 16 7
Clyde Valley	8	8	37/–	−2/–	4 6 6
County of London	8	10	42/–	..	4 15 3
Edmundsons	6	6	27/–	−6d.	4 9 0
Elec.Dis.Yorkshire	9	9	41/3	..	4 7 4
Elec. Fin. and Securities	12½	13½	56/–	−⅛	4 16 5
Elec. Supply Corporation	10	10	43/6	−¼	4 12 0
Lancs. Light and Power	7½	7½	30/6	−1/–	4 18 4
Llanelly Elec.	6	6	25/6	..	4 14 1
Lond.Assoc.Electric	3	4	26/6	..	4 10 7
London Electric	6	6	26/6	−1/–	4 10 /
Metropolitan E.S.	8	9	42/–	−6d.	4 5 9
Midland Counties	8	8	42/–	−6d.	3 16 2
Mid. Elec. Power	9	9	42/6	−6d.	4 4 8
Newcastle Elec.	7	7	30/–	..	4 13 4
NorthEasternElec.	7	7	30/–	−1/–	4 13 4
Northampton	10	10	47/6	..	4 4 6
Northmet Power	7	9	40/–	−6d.	4 10 0
Richmond Elec.	6	6	27/–	..	4 9 0
Scottish Power	8	9	36/–	−1/6	4 18 8
Southern Areas	5	5	22/3	..	4 10 6
South London	7	7	30/–	..	4 13 4
West Devon	5	5	26/–	+6d.	3 17 5
West Glos.	4½	3½	27/–	−6d.	2 11 10
Yorkshire Elec.	8	9	41/6	..	4 6 10
Public Boards					
Central Electricity:					
1955–75	5	5	115	+½	4 7 0
1951–73	4½	4½	107	+1	4 4 0
1963–93	3½	3½	108	+2	3 4 10
1974–94	3½	3½	105	+1	3 2 0
LondonElec.Trans.	2½	2½	101	+1½	2 9 6
London & Home Counties 1955–75	4½	4½	112	..	4 0 5
Lond.Pass.Trans.Bd.					
A	4½	4½	123½	..	3 13 0
B	5	5	118	+½	4 4 5
C	3	3	60	+3	5 0 0
West Midlands J.E.A. 1948–68	5	5	105½	..	4 14 9
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	9/–	+3d.	—
Calcutta Elec.	6*	6*	60/6	+1/6	1 19 9
Cawnpore Elec.	7	13	62/6	−3/–	4 2 10
East African Power	7	7	39/6	−6d.	3 10 10
Jerusalem Elec.	7	5	25/6	..	3 18 6
Kalgoorlie (10/–)	5	5	12/–	..	4 3 4
Madras Elec.	4	6	36/6	−6d.	3 5 10
Montreal Power	1½	1½	26	−1	—
Nigerian Elec.	10	10	40/–	−1/–	5 0 0
PalestineElec."A"	5*	5*	37/6	..	2 13 4
Perak Hydro-elec.	6	7	17/–	−½	—
Tokyo Elec. 6%	6	6	37½	+3	—
VictoriaFallsPower	15	15	5⅝	+⅛	2 16 7
Whitehall Inv. Pref.	—	6	26/9	..	4 9 9

Company	Dividend Previous	Dividend Last	Middle Price Apl. 26	Month's Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord.	10	15	65/6	..	4 11 6
Assoc. Brit. Eng.	6	7	47/6	..	2 14 4
Assoc. Elec.:					
Ord.	10	10	65/3	+⅛	3 1 4
Pref.	8	8	41/3	..	3 17 8
AutomaticTel.&El.	12½	12½	76/3	+7/9	3 5 7
Babcock & Wilcox	11	12	60/–	..	4 0 0
British Aluminium	10	8	39/–	+6d.	4 2 1
British Insulated & Callender's	..	..	47/–	+6d.	—
British Thermostat (5/–)	18½	18½	23/–	..	4 0 5
BritishVac.Cleaner (5/–)	30	30	37/6	−6d.	4 0 0
Brush Ord. (5/–)	9	10	12/3	+9d.	4 1 6
Burco (5/–)	15	20	22/9	+⅛	4 7 9
ChlorideEl.Storage	15	15	87/6	..	3 8 6
Christy Bros.	12½	17½	80/–	+⅛	4 7 6
Cole, E. K. (5/–)	20	20	35/–	+½	2 17 2
Consolidated Sig.	24	27½	6½	..	4 3 3
Cossor, A. C. (5/–)	10*	12½*	39/–	−1/9	1 12 0
Crabtree (10/–)	17½	17½	50/–	+4/–	3 10 1
Crompton Parkinson Ord. (5/–)	22½	22½	32/6	+2/–	3 9 3
De La Rue	40	40	11½	+½	3 12 0
Decca (1/–)	100	112	60/–	−⅛	1 17 3
E.M.I. (10/–)	8	8	34/9	+3/3	2 6 0
Elec.Construction	10	12½	65/–	+5/–	3 17 0
Enfield Cable Ord.	12½	12½	66/–	+1/9	3 15 4
English Electric	10	10	66/–	+11/–	3 0 6
Ericsson Tel. (5/–)	22*	20*	59/–	+5/3	1 13 8
Ever Ready (5/–)	40	40	50/6	+1/6	3 19 2
Falk Stadelmann	7½	10	43/9	+9d.	4 11 4
Ferranti Pref.	7	7	34/6	..	4 1 2
G.E.C.:					
Pref.	6½	6½	35/–	+1/–	3 14 4
Ord.	17½	17½	5⅛	+7/3	3 9 5
GeneralCable(5/–)	15	15	20/–	+2/–	3 15 0
Greenwood&Batley	15	15	47/6	..	6 6 1
H.T.A. (10/–)	12½	10	28/9	+9d.	3 9 7
Henley's (5/–)	20	20	28/6	+1/–	3 10 2
4½% Pref.	4½	4½	25/–	+3d.	3 12 0
Hopkinsons	17½	20	92/6	..	4 6 7
India Rubber Pref.	5½	5½	25/6	..	4 9 9
Intl. Combustion	30	32½	8⅛	..	3 19 3
Johnson & Phillips	15	15	84/3	+1/9	3 11 3
LancashireDynamo	22½	22½	6	+½	3 15 0
Laurence,Scott(5/–)	12½	12½	14/6	+9d.	4 6 3
London Elec. Wire	7½	7½	41/–	+6d.	3 13 2
Mather & Platt	10	10	55/–	+2/–	3 12 9
Metal Industries(B)	8½	9	55/–	+6/–	3 5 6
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Mid. Elec. Mfg.	25	25	8½	+½	3 1 6
Murex	20	20	92/6xd	−½	4 6 6
Newman Ind.(2/–)	20	20	9/3	..	4 6 7
Power Securities	6	6	29/–	..	4 2 9
Pye Deferred(5/–)	25	25	40/–	+⅛	3 2 6
Radio & Tel. (2/–)	25	15	10/9	−3d.	1 17 3
Revo (10/–)	17½	17½	53/–	+3/3	3 6 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Apl. 26	Month's Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing (*Continued*)					
Reyrolle ..	12½	12½	75/3	+9d.	3 6 6
Siemens Ord. ..	7½	7½	42/–	+1/–	3 11 5
Strand Elec. (5/–)	10	12½	11/6	..	5 8 8
Switchgear & Cowans (5/–) ..	20	20	26/–	+2/3	3 17 0
T.C.C. (10/–) ..	10	12½	25/–	+1/–	5 0 0
T.C. & M. ..	10	10	60/–	..	3 6 8
TelephoneMfg.(5/–)	9	9	15/6	+½	3 0 8
Thorn Elec. (5/–)	20	20	33/–	+½	3 0 8
Tube Investments	20	22½	6½	+1/6	3 14 0
Vactric (5/–) ..	22½	Nil	31/–	+10/3	—
Veritys (5/–) ..	7½	7½	8/6	..	4 8 3
WalsallConduits(4/–)	55	55	61/3	+6/9	3 12 0
Ward & Goldstone (5/–)	20	25	37/6	+½	3 7 7
WestinghouseBrake	14	14	77/–	+3/–	3 12 9
West, Allen (5/–)	7½	7½	9/6	+9d.	3 19 9
Traction and Transport					
Anglo-Arg. Trans.:					
First Pref. (£5)	Nil	Nil	1/6	–3d.	—
4% Inc. ..	Nil	Nil	5	+1½	—
Brit.Elec.Traction:					
Def. Ord. ..	45	45	1145	+70	3 18 6
Pref. Ord. ..	8	8	175	+2	4 11 6
Bristol Trams ..	10	10	49/–	..	4 1 8
Brazil Traction ..	2	2	30½	+1	6 11 2
Calcutta Trams ..	6½	7½	65/6	..	2 5 9
Cape Elec. Trams	5	6	30/6	..	3 18 8
Lancs. Transport	10	10	43/6	..	4 12 0
Southern Rly.:					
5% Prefd. ..	5	5	75	+½	6 8 0
5% Pref. ..	5	5	112	+1½	4 9 0
T. Tilling ..	10	10	52/6	+6d.	3 16 3
West Riding ..	10	10	43/9	..	4 11 4
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	129½	+3	4 12 8
Def.	1½	1½	31½	–1	4 15 4
Anglo-Portuguese	8	8	28/6	..	5 12 4
Cable & Wireless:					
5½ Pref. ..	5½	5½	114	+2	4 16 6
Ord.	4	4	104	+8½	3 17 0
CanadianMarconi	$1 Nil	4 cts.	18/9	+9d.	—
Globe Tel. & Tel.:					
Ord.	8¼*	5*	43/–	..	2 6 9
Pref.	6	6	32/–	..	3 15 0
Great Northern Tel. (£10)	Nil	Nil	30	+1½	—
Inter. Tel. & Tel.	Nil	Nil	31	+2	—
Marconi-Marine ..	7½	7½	35/–	+1/6	4 9 0
Oriental Tel. Ord.	4	4	60/–	+½	—
Telephone Props.	Nil	6	20/6	..	5 17 1
Tele.Rentals(5/–)	10	10	13/6	+9d.	3 14 1

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 707)

facturing programme on the conclusion of the war. The 10s. shares are 9d. better at 28s. 9d. Laurence, Scott & Electromotors dividend for 1945 is again 12½ per cent, on which the 5s. shares, at 14s. 6d., return £4 6s. 3d. per cent. Watford Electric 2s. shares stand at 8s., to yield 4¾ per cent on the 15 per cent dividend lately declared.

Electrical Equipment

On the assumption that both at home and in the export market the demand for electrical equipment and apparatus of all kinds is going to keep that industry busily employed for a long time to come, inquiry for shares in the smaller companies is active. In some cases, a generous yield compensates for lack of marketability. It may be of use to mention a few such issues, of which shares are at present on offer in reasonable numbers.

British Rola 2s. shares, to which attention was drawn by the reported acquisition of control of the Celestion Company, have been changing hands around 6s. 6d., at which price the yield on the 15 per cent dividend is £4 12s. 3d. per cent. British Electric Resistance 2s. ordinary pay close on 5½ per cent on the money at the offered price of 7s. 6d. The yield on Strand Electrics, at 12s*, is just under 5¼ per cent. Rheostatic 4s. shares have hardened lately to 12s., and yield exactly 4 per cent. On Heatrae 2s. shares, offered at 6s. 6d., the return is a little over 3¾ per cent, and on Peto Scott, at 10s. 6d., it is 1 per cent more. These yields are based, of course, on the last full year's dividends paid. A 5 per cent return is given by Telegraph Condenser 10s. shares at 25s., and by Ultra Electrics at 10s.

Walsall Conduits

Walsall Conduits have gone ahead during the month, the price at 61s. 3d. showing a rise of 6s. 9d. The company manufactures steel conduits and accessories required in connection with electric lighting and power installations. It also specializes in various articles connected with the electrical trades. The capital is £350,000, of which £200,000 is in 5 per cent preference shares of £1 each, the remaining £150,000 being in 4s. ordinary shares. These last-named have received an annual dividend of 55 per cent for many years past, out of earnings substantially higher. For the year ended December, 1940, for instance, earnings were 107 per cent; for 1944, 92 per cent. The price of the shares in the black days of 1940 fell at one time to 18s., and the present price is nearly the highest reached for years past. On the 55 per cent dividend, the yield now is £3 12s. per cent.

Dash-board Telephones for Cars

Communications between San Francisco motorists and their homes and offices will be possible by June with the introduction of dash-board radio telephones, announces the Pacific Telephone & Telegraph Co. Work has begun at the telephone building at San Franscisco on a 500-ft antenna for the service.—*Reuter.*

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *may be obtained from the Patent Office*, 25, *Southampton Buildings, London, W.C.*2.

AKT.-GES. Brown, Boveri & Cie.—" Pipe bends for the pressure gas piping of gas-blast circuit breakers." 1139/44. January 20th, 1943. (576568.)

F. Aughtie.—" Circuits for measuring electrical resistances, such as strain gauges." 3747. February 29th, 1944. (576639.)

Automatic Telephone & Electric Co., Ltd., and E. E. Comfort.—" Automatic switches as used in telephone systems." 3892. March 2nd, 1944. (576670.)

Bendix Aviation Corporation.—" Movement equalizing means for fluid-pressure and electric motors." 16747/43. December 10th, 1942. (576590.)

British Thomson-Houston Co., Ltd.—" Electrical connections." 6802/44. April 16th, 1943. (576648.)

British Thomson-Houston Co., Ltd., and L. Griffiths.—" Mechanism for electrifying fences." 23340. November 23rd, 1944. (576614.)

Callender's Cable & Construction Co., Ltd., and N. G. Simpson.—" Means for the attachment of electric wires and cables to insulators." 22266. November 11th, 1944. (576612.)

Carr Fastener Co., Ltd., and G. Wagstaff.—" Holders for thermionic valves and like electrical devices and means for securing them to supports." 5178. March 20th, 1944. (576575.) " Holders for thermionic valves, and other electrical devices." 5611. March 27th, 1944. (576581.)

English Electric Co., Ltd., G. Chadwick and J. E. Salthouse.—" Cooling of electrodes." 1030. January 19th, 1944. (576525.)

Ericsson Telephones, Ltd., and D. C. Crowe.—" Electrical contact springs." 15026. August 8th, 1944. (576608.)

Express Lift Co., Ltd., and W. A. Dixie.—" Driving arrangements for lifts, hoists and the like." 1788. January 31st, 1944. (576528.)

General Electric Co., Ltd., and A. S. Gladwin.—" Electrical frequency discriminator circuits." 3996. March 3rd, 1944. (576672.)

General Electric Co., Ltd., and C. C. Puckette, Jun.—" Centrifugal brakes." 23827. November 29th, 1944. (576615.)

Gent & Co., Ltd., and E. O. Chapman.—" Time-recording apparatus." 5577. March 25th, 1944. (576645.)

Heenan & Froude, Ltd., and C. T. Hayes.—" Controlling means for eddy current clutches, brakes and dynamometers." 1725. February 10th, 1942. (576558.)

Holophane, Ltd., and S. English.—" Refractors for use in street lighting." 17970. October 30th, 1943. (576591.)

H. W. K. Jennings (Sun-Kraft, Inc.).—" Electric lamps for therapeutic treatment." 3478. February 24th, 1944. (576574.)

Loewy Engineering Co., Ltd., and H. R. Fernbach.—" Electrical drives for rotary shears." 7416. April 21st, 1944. (576583.)

B. Long.—" Method eliminating the colouration of glass obtained by electric melting." 11551/41. September 4th, 1940. (576653.)

Mallory Metallurgical Products, Ltd.—" Electrical contacts." 17465/43. October 23rd, 1942. (576566.)

Marconi's Wireless Telegraph Co., Ltd. (Radio Corporation of America).—" Mechanism for feeding short lengths of wire." 7463. June 2nd, 1942. (Convention date not granted). (576559.)

Mond Nickel Co., Ltd.—" Production of massive nickel for use as anodes." 10799/44. June 12th, 1943. (576650.)

N. E. Nelander.—" Safety device for electric overhead lines." 2322/45. February 1st, 1944. (576617.)

Novobax, Ltd., and A. V. Sharman.—" Electrical connectors." 3009. February 17th, 1944. (576535.)

O. & F. Co. Proprietary, Ltd.—" Arc welding electrodes." 19763/43. September 18th, 1943. (576523.)

Pirelli-General Cable Works, Ltd., J. J. Wright and H. C. R. Corbidge.—" Electric cables." 8329. May 3rd, 1944. (576585.)

M. Raht.—" Connector for ceramic condensers." Cognate applications 16312/43 and 21210/43. October 5th, 1943. (576589.)

G. R. Shepherd (Westinghouse Electric International Co.).—" Electrical insulation material." 898. January 17th, 1944. (576599.)

Syncro Machine Co.—" Cable pull-off mechanism." 16630/43. November 3rd, 1942. (576661.)

J. Topping, Jun.—" Pressure control loud speaker enclosure." 700. January 13th, 1944. (576595.)

W. W. Triggs (Pan Akt.-Ges.).—" Electromagnetic relays." 5495. April 6th, 1943. (Convention date not granted.) (576623.)

F. C. Turner.—" Cable or conduit joints or in connecting cables or conduits for junction boxes and the like." 3179. February 21st, 1944. (576573.)

Westinghouse Brake & Signal Co., Ltd., L. E. Thompson and A. Jenkins.—" Dry alternating current rectifiers of the dry surface contact type." 3911. March 2nd, 1944. (576671.)

Westinghouse Electric International Co.—" Electrical semi-conducting members." 21032/43. December 3rd, 1942. (576631.)

M. P. Winther.—" Automatic speed governing means controlling eddy current clutches." 2939/42. June 28th, 1941. (576620.)

P. D. Zurian.—" System for telephoto scanning." 2070. February 8th, 1943. (576622.)

Secret Patents Re-assigned

N. F. S. Hecht.—" Wireless direction finding apparatus." Cognate applications 8531/38 and 19289/38. March 19th, 1938. (Complete specification accepted August 12th, 1939.) (Patent sealed August 12th, 1939.) (576555.)

Amended Specifications Published

569222. British Thomson-Houston Co., Ltd.—" Vitreous products."

571349. Babcock & Wilcox Co.—" Metallic structures for high temperature service."

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Atherton.—May 31st. U.D.C. Cables and transformers. (See this issue.)

Australia.—June 17th. Bowen Town Council, Queensland. 1,000-kW turbo-alternator. A. E. Axon, consulting engineer, Parbury House, Eagle Street, Brisbane.

Bedwas & Machen.—May 6th. U.D.C. Switchgear, substation kiosks, transformers, transmission line and cables. (April 26th.)

Birkenhead.—May 14th. Electricity Department. Cables, meters and general stores for twelve months. (April 26th.)

Bury.—May 11th. Corporation. Concrete lighting standards, sodium lamp control equipment and 65-W lanterns. (See this issue.)

Camberwell.—May 13th. Borough Council. Electric lamps for nine months from July 1st. Borough engineer, Town Hall, S.E.5.

Ealing.—May 20th. Electricity Department. 1,000-kVA and 7,500-kVA transformers and 11-kV switchgear. (See this issue.)

Edinburgh.—May 10th. City Council. 33-kV transformer and reactors. (April 19th.)

Heywood.—May 7th. Electricity Department. Six 500-kVA transformers. (April 26th.)

India.—June 28th. Madras Government Electricity Department. 15,000-kW turbo-alternator for Basin Bridge "B" power station. (See this issue.)

Leeds.—May 8th. Transport Committee. Tramcar motors. (April 26th.)

Manchester.—May 7th. Electricity Department. Electric fan motors for one year and static transformers for two years. (April 26th).

North Scotland.—May 20th. Hydro-Electric Board. 11-kV overhead lines, Loch Fannich area. (See this issue.)

June 10th. High- and low-voltage overhead lines, Bute and South Cowal, and on the island of Lewis. (See this issue.)

Oldbury.—May 17th. Town Council. Mercury discharge street lighting. (See this issue.)

Plymouth.—May 15th. Electricity Supply Department. Conveyor belts, electric motors and control gear, substation distribution boards and accessories and alkaline battery for switchgear closing and tripping. (See this issue.)

Sheffield.—May 27th. Electricity Department. One reinforced concrete cooling tower for Neepsend generating station. (April 26th.)

Shipley.—May 4th. Electricity Department. Paper-insulated power cables. (April 26th.)

Orders Placed

Croydon.—Electricity Committee. Recommended. Ring busbar and circuit-breaker; also switchgear for twelve months.—A. Reyrolle & Co. Transformers for twelve months.—Lindley Thompson Transformer Co.

Glasgow.—Corporation Transport Committee. Recommended. Electrical equipment for 100 tramcars (£156,200).—Metropolitan-Vickers.

Darlington. — Town Council. Accepted. Rectifier equipment for Wilson Road substation (£1,595).—Hewittic Electric Co.

Hammersmith. — Electricity Committee. Accepted. E.h.v. switchgear (£5,147).—J. G. Statter & Co. L.v. switchgear (£1,201).—W. Lucy & Co. Three 500-kVA and four 1,000-kVA transformers (£4,828).—Bonar Long & Co.

London.—Joint Electricity Authority. Local Distribution Committee. Recommended. Extension of the following contracts for a further period of twelve months: Kiosks and underground cables.—Crompton Parkinson. Underground cables.—Hackbridge Cable Co. and Connolly's (Blackley). Electrical accessories.—Drake & Gorham Wholesale.

Watford.—Electricity Committee. Accepted. Switchgear for substations (£1,838).—Metropolitan-Vickers.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Anglesey.—Proposed erection of new offices, adjoining Shire Hall, Llangefni; J. E. Rees, county architect, Glanaber, Llangefni.

Audenshaw.—Permanent houses (76), Stamford Road; C. Wild, architect, 72, Bridge Street, Manchester, 3.

Berwick-on-Tweed.—Houses (40), Shielfield Terrace, Tweedmouth; J. H. Pierce, builder, Chirnside.

Birkenhead.—Two county colleges; B. Robinson, borough engineer, Town Hall.

Bromsgrove.—Infants' school, Sidemoor, and junior and infants' school, Stoke Heath; L. C. Lomas, county architect, 60, The Tything, Worcester.

Caterham.—Flats (33), Whyteleafe Court, Burntwood Lane; S. H. Burdwood, 71, Portland Place, London, W.1.

Chatham.—Houses (52), Wayfield estate; Stoner & Sons, surveyors, 69, Lincoln's Inn Fields, London, W.C.2.

Cheltenham.—Houses (76), Lynworth estate; G. Gould Marsland, borough engineer, Municipal Offices.

Cockermouth.—Houses (28), for the U.D.C.; J. Twiname, Ltd., builders, Brigham, Cumberland.

Cowes (I.O.W.).—Houses (30), Gort Road housing site, East Cowes; engineer and surveyor, Northwood House.

Crayford.—Houses (40), Heath Road; P. J. Palmer & Son, Ltd., builders, Welling.

Crook and Willington.—Permanent houses (50), Nelson Street site; T. A. Page, Son & Hill, architects, 75, King Street, South Shields.

Croydon.—School extensions and kitchens (£9,000); borough engineer.

Factory extensions, 127-133, High Street; Marshall's Food Products, Ltd.

Darlington.—Houses (50), Nickstream Lane; F. Hills & Son, builders, Manchester.

Dornoch.—Houses (22), for Town Council; burgh surveyor.

Dover.—Houses (45), Old Park Hill Corner, Buckland Valley and Green Lane Farm estate; borough engineer and surveyor, Maison Dieu House.

Dudley.—Permanent houses (194), Holly Hall estate; Henry Vale & Sons, surveyors, Wolverhampton.

Dulverton.—Houses (34), Jury Road site (£40,783) for R.D.C.; W. White & Sons, builders, Wiveliscombe.

Epping.—Houses (20), Primley Lane, Sheering, and 14 houses, Linford End, Parndon, for the R.D.C.; Tooley & Foster, architects, Midland Bank Chambers, Buckhurst Hill, Essex.

Glasgow.—Maternity unit and nurses' home, Robroyston Hospital; city architect.

Higham Ferrers.—Permanent houses (34), High Street estate; J. W. Lloyd, borough surveyor.

Hornsea.—Houses (84), off Rowlston Road; Blackmore & Sykes, architects, Ruskin House, 141, Princess Avenue, Hull.

Horsham.—Houses (26), Orchard Road and McLeod Road; C. O. Atkinson, surveyor, Council Offices.

Inverness.—Houses (48) (£57,000); burgh surveyor.

Islington.—Tenements (285), Carlsbad site; borough architect.

Keith (Banffshire).—Houses (38), for Town Council; burgh surveyor.

Kirkcudbright.—Houses (40) for Town Council; town clerk.

Lanark.—Houses (110) A. V. Wilson, architect, 7-9, Calder Street, Motherwell.

Lancaster.—Electrical installations in 73 houses, Hare Runs estate; F. Hill, city surveyor.

Lichfield.—Permanent houses, Birmingham Road, Shenstone (44), Shenstone Wood End (46) and Brook End, Fazeley (38); A. T. & Bertram Butler, architects, Wolverhampton.

Macclesfield.—Houses (46), Ivy Road; J. Gerrard & Sons, Ltd., builders, Swinton, Manchester.

Milnrow.—Houses (116), Bentgate Street, Newhey; A. Travis, architect, New Market Chambers, Yorkshire Street, Rochdale.

Newcastle-on-Tyne.—Showroom, offices, etc., Orchard Street, for J. T. Doves, Ltd.; J. Oswald & Son, architects, Bradburns Chambers.

Permanent houses (26); R. S. Appleby & Co., builders, Clayton Street, Newcastle.

Newport (Mon.).—Houses (134), Alway Farm estate; town clerk, Town Hall.

North Riding.—Junior and infant school, Northallerton, and new school at Whitby; county architect, County Hall, Northallerton.

Northenden. — Factory extensions, Harper Road, for V. H. Iddon, Ltd.; D. Macdonald, Ltd., builders, Trafford Bar, Manchester, 16.

Portsmouth.—Houses (62), Pauls Grove; city architect, 1, Western Parade, Southsea.

Preston.—Permanent houses (22), in pairs, Lindle Lane, Hutton; Lancashire county architect, G. Noel Hill, County Offices.

Renfrew.—Houses (36), at Thornlie Bank; county engineer, Paisley.

Ringwood.—Eleven pairs of houses, Parsonage Barn Lane site; F. Andrews, architect, 45, High Street.

Royston Yorks).—Houses (30), Pinfold Lane, for the U.D.C.; Dyson, Cawthorne & Coles, architects, 25, Regent Street, Barnsley.

Rugby.—Permanent houses (42), Shilton, Church Lawford, Churchover and Frankton, for R.D.C.; D. G. McVinnie, surveyor, 24, Warwick Street.

Solihull.—Houses (62), Cranmore Boulevard housing site; C. R. Hutchinson, engineer and surveyor, 90, Station Road.

Spennymoor.—Houses (112) for U.D.C.; G. Pearson & Son, Houghton Road, Hetton-le-Hole, Co. Durham.

Stockton-on-Tees.—Houses (100), Green Lane; borough architect.

Stoke Newington.—Flats (76), Milton Grove (£98,268); C. Miskin & Sons, Ltd.

Stranraer.—Houses (126), for Town Council; burgh surveyor.

Thornton Heath.—Factory extension, Mayday Road; Ellis Optical Co.

Walsall.—Works additions, Thomas Street; T. H. Mold & Sons, founders, Vulcan Foundry.

West Kesteven.—Houses (36), on sites at Caythorpe, Dry Dodington, Ropsley, Carlton Scroop, Great Gonerby and Bankston; F. J. Lenton & Partners, 16, Broad Street, Stamford.

Wigston.—Houses (112), Clarke's Road and Central Avenue (£141,067); Drury & Co., Ltd., contractors, Windmill Avenue, Kettering.

Wilmslow.—Houses (114) for U.D.C.; Halliday & Agate, 14, John Dalton Street, Manchester, 2.

Witham.—Houses (64), Church Street for U.D.C.; A. E. Wiseman, architect, 10, Duke Street, Chelmsford.

Wood Green.—New municipal offices; Brown & Henson, architects.

Street Lighting

A PAPER by Dr. English on "Post War Street Lighting" given to the Birmingham Centre of the Illuminating Engineering Society, on April 5th drew a large audience. He said that unlike some other fields of science, no world-shaking discoveries in street lighting practice had come about as a result of the war, although there were some useful lessons to be learned from the black-out. The precise cut-off of A.R.P. fittings had shown us how well we could see with 0·0003 f.c., when there was freedom from glare. Dr. English commented at length on the draft specification which was being prepared to implement the Final Report of the Departmental Committee of the Ministry of Transport, and gave much useful information illustrated with lantern slides.